This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

Eng 1019.10

Harvard College Library

FROM THE

UNITED STATES GOVERNMENT

THROUGH

Eng 1019.10

61ST CONGRESS, 2d Session } (1909-1910) SENATE { REPORT No. 527

REPORT ON THE

RIVER AND HARBOR BILL

BY THE COMMITTEE ON COMMERCE
UNITED STATES SENATE

APRIL 11, 1910

Submitted by Mr. NELSON, and ordered to be printed

WASHINGTON
GOVERNMENT PRINTING OFFICE
1910

Eng 1019.10

HARVARD COLLEGE LIBRARY
APR 20 1910

M. L. Sorenson

BOUND. JUN 20 1910

Calendar No. 495.

61ST CONGRESS, 2d Session. | SENATE. | REPORT No. 527.

RIVER AND HARBOR BILL.

APRIL 11, 1910.—Ordered to be printed.

Mr. NELSON, from the Committee on Commerce, submitted the following

REPORT.

[To accompany H. R. 20686.]

The Committee on Commerce, to whom was referred the bill (H. R. 20686) making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes, having considered the same, submit the following report, giving such extracts from official documents in respect to each item as are deemed essential to an appreciation of its merits.

The bill as it came from the House carried—

Appropriations aggregating	$35,351,746.50
And authorizations of contracts to be provided for by future appropriations amounting to	7,206,430.00
Total	42,558,176.50

The net increases in the bill as reported to the Senate are:

Appropriations	$6,380,567.00
Contracts authorized	3,627,675.00
Total increase	10,008,242.00

The bill as reported to the Senate, therefore, carries appropriations aggregating $41,732,313.50, and authorizations of continuing contracts amounting to $10,834,105, giving a grand total of $52,566,418.50.

The "continuing-contract" provision was first introduced in the river and harbor act of 1900, applying to but very few items in that act, but to more in succeeding bills.

For list of increases and amounts for each State see last pages of report.

The annual expenditures for river and harbor improvements since 1896, as stated in the annual reports of the Chief of Engineers, have been as follows:

1896	$17,039,731
1897	13,461,395
1898	17,161,799
1899	15,167,294
1900	18,671,340
1901	19,621,227
1902	15,410,647
1903	18,327,871
1904	23,925,096
1905	24,648,697
1906	24,115,597
1907	23,092,070
1908	28,251,972
1909	36,753,285

During these fourteen years there have been five general and three emergency river and harbor acts, making provisions as follows:

1896.	Appropriations	$12,659,550	
	Contracts authorized	59,616,405	
			$72,275,955
1899.	Appropriations	16,091,841	
	Contracts authorized	23,866,324	
			39,958,165
1900.	Appropriation (emergency)		560,000
1902.	Appropriations	26,771,442	
	Contracts authorized	38,336,160	
			65,107,602
1904.	Appropriation (emergency)		3,000,000
1905.	Appropriations	18,181,875	
	Contracts authorized	17,184,657	
			35,366,532
1907.	Appropriations	37,108,083	
	Contracts authorized	49,829,349	
			86,937,432
1909.	Appropriations (emergency)	9,435,750	
	Contracts authorized	635,875	
			10,071,625

During the same period appropriations have been made in sundry civil acts for river and harbor improvements, principally to provide for contracts authorized in above acts, as follows:

1896	$3,284,597	1903	$20,228,150
1897	19,121,412	1904	7,872,200
1898	14,061,613	1905	10,544,132
1899	8,918,197	1906	17,254,050
1900	15,725,605	1907	6,392,730
1901	7,046,623	1908	18,092,945
1902	5,768,757	1909	19,754,514

Actual appropriations in both acts for such improvements, during these years have been as follows:

1896.	River and harbor act	$12,659,550	
	Sundry civil act	3,284,597	
			$15,944,147
1897.	Sundry civil act		19,121,412
1898.	Sundry civil act		14,061,613
1899.	River and harbor act	16,091,841	
	Sundry civil act	8,918,197	
			25,010,038
1900.	River and harbor act	560,000	
	Sundry civil act	15,725,605	
			16,285,605

1901.	Sundry civil act		$7,046,623
1902.	River and harbor act	$26,771,442	
	Sundry civil act	5,768,757	
			32,540,199
1903.	Sundry civil act		20,228,150
1904.	River and harbor act	3,000,000	
	Sundry civil act	7,872,200	
			10,872,200
1905.	River and harbor act	18,181,875	
	Sundry civil act	10,544,132	
			28,726,007
1906.	Sundry civil act		17,254,050
1907.	River and harbor act	37,108,083	
	Sundry civil act	6,392,730	
			43,500,813
1908.	Sundry civil act		18,092,945
1909.	River and harbor act	9,435,750	
	Sundry civil act	19,754,514	
			29,190,264

BREAKWATER FROM MOUNT DESERT TO PORCUPINE ISLAND, BAR HARBOR, ME.

The object of the breakwater is to protect the wharves of Bar Harbor and the anchorage in front of the town from the heavy seas of southerly gales.

The act of August 11, 1888, made an appropriation for commencing the work. The project was modified in 1893 as to length of breakwater, and now provides for a structure of riprap stone, extending from Porcupine Island 2,500 feet in a westerly direction to a point about 600 feet from the low-water line on Mount Desert Island. The top of the breakwater is to be at the level of mean high tide, 20 feet wide, and the side slopes such as the rock assumes—about 1 on 1. The estimate of cost was based on the expectation that 382,000 tons of stone would be required, and was placed at $420,200.

The expenditures to June 30, 1909, were $219,559.61. There was no work in progress during the fiscal year 1909, the expenditures practically representing payments for contract work completed the previous year.

The breakwater has been built to full section for a length of about 1,859 feet, leaving about 641 feet yet to be constructed; the total quantity of stone deposited to the present time is 211,534 tons.

The tonnage for the calendar year 1908 is reported as about 332,000 tons, with an estimated value of $4,774,890. The great increase in quantity is explained as chiefly due to the erection of several large brick and stone buildings, the materials for which were received by water.

The beneficial effects resulting from the portion of the breakwater already built in protecting the wharves at Bar Harbor and the anchorage basin, which is extensively used by costly pleasure craft during the summer season, are appreciably felt, but in order to secure the desired protection at high water of spring tides it may be found necessary to raise the breakwater to a height of about 6 feet above mean high tide. The mean range in tides is 11.5 feet.

The benefits to navigation are general in providing a harbor of refuge and local in making it possible for boats to land at the wharves at all times with safety. The only convenient method of transportation to and from Bar Harbor is by boat.

The new appropriation estimated for is to be applied in extending the breakwater in accordance with the project

July 1, 1908, balance unexpended	$13,997.30
June 30, 1909, amount expended during fiscal year for works of improvement	13,556.91
July 1, 1909, balance unexpended	440.39
Amount (estimated) required for completion of existing project	200,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	50,000.00

CAMDEN HARBOR, MAINE.

The following report of the Board of Engineers is concurred in by the Chief of Engineers and printed in House Document No. 1117, Sixtieth Congress, second session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. D., October 12, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

The further improvement of Camden Harbor proposed by the district officer to meet the desires of local interests is the dredging to a depth of 10 feet at mean low water of an area of about 3¼ acres at the upper end of the harbor. The cost of this work is estimated at $20,000, and an annual allowance of $1,000 will be required for the maintenance of the improvement.

The district officer mentions certain recent commercial developments at this harbor and expresses the opinion that any addition to its capacity would be fully utilized. The division engineer concurs with the district officer in the opinion that Camden Harbor is worthy of further improvement by the General Government to the extent now proposed.

Considering only the commerce reported in recent years at this harbor, on which over $80,000 has already been expended by the United States, the Board would be inclined to question the advisability of making this additional expenditure, but in view of recent commercial developments giving promise of increased tonnage in the future, and the fact that the harbor provides a safe anchorage for a large number of vessels, the Board concurs in the opinion of the district officer and the division engineer that it is advisable for the United States to undertake the further improvement of Camden Harbor by the dredging to a depth of 10 feet at mean low water of an area of about 3¼ acres in the upper harbor at an estimated cost of $20,000, the estimated cost of maintenance being $1,000 per annum.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

Commercial statistics for calendar year 1906.

RECEIPTS AND SHIPMENTS.

	Tons.		Tons.
Bricks and clay	800	Hay and straw	50
Cement	500	Iron and stone	250
Coal	1,500	Lumber	3,000
Fertilizer	50	Sand	1,500
Flour	200	Wood	1,000
General merchandise	5,000	Miscellaneous	3,500
Grain	2,000		

A new marine railway has been established here recently. A large number of pleasure yachts make this their harbor in summer.

EAST BOOTHBAY HARBOR, MAINE.

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 944, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., March 2, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

In view of the small cost involved in the improvement now proposed at this harbor, and the dependence of the people of the locality on water transportation, the Board concurs with the district officer and the division engineer in recommending the project proposed within, at an original estimated cost of $4,000 and about $400 annually thereafter for maintenance.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

The area proposed to be dredged to a depth of 8 feet at mean low water extends from the Damariscotta steamboat landing to the Portland steamboat wharf and as far back toward the other wharves as this depth can be obtained by dredging and without the removal of ledge.

The business done in the village immediately surrounding this harbor is estimated to amount to from $80,000 to $100,000 annually, and as there is no railroad nearer than 13 miles practically all transportation is done by water. There is one steamboat which makes three round trips weekly and which carries all the heavier freight. Another steamboat line runs up the river to Damariscotta, making two round trips daily from June 1 to October 1 and one round trip during the balance of the year when the river is not closed with ice. The business of this line consists mainly in carrying passengers and light freight. It is claimed that about 9,000 passengers are carried annually. Coal for domestic consumption—about 1,000 tons annually—is brought in small schooners.

MATINICUS HARBOR, MAINE.

Matinicus, Maine, is the largest of a group of islands in the Atlantic Ocean, off the mouth of Penobscot Bay, and about 20 miles from Rockland Harbor, Maine.

Lying as it does in the open ocean, it is very much exposed and at the same time has the misfortune of possessing no reasonably safe harbor, even for small vessels.

A fishing fleet valued at about $37,500 makes its headquarters at Matinicus Harbor, and the annual catch of the fleet has been estimated at about $48,000. To this must be added the supplies of various kinds needed for the support of the population.

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 653, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., January 15, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

In the within report the district officer estimates that a suitable breakwater can be constructed between Youngs Point and Indian ledge at a total cost of $13,000, which will afford adequate protection to vessels and property in Matinicus Harbor.

Having in mind the small cost of the proposed breakwater and the undoubted benefit which its construction will confer upon the fishing interests centered at this locality, by preventing losses similar to those which have resulted from easterly storms in the past, the Board concurs with the district officer and the division engineer in the opinion that Matinicus Harbor is worthy of improvement to the extent contemplated by the project now presented.

PEPPERELLS COVE, MAINE.

The following report of the Board of Engineers, in which the Chief of Engineers concurs, is printed in House Document No. 1081, Sixtieth Congress, second session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., October 26, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

In its reports of November 25, 1907, the Board expressed the opinion, based on the results of a personal inspection of the locality and the information presented at a public hearing, that if Pepperells Cove could be made available as a harbor of refuge at moderate cost its improvement by the General Government would be advisable, and a survey and estimate of cost were recommended.

In the within report on the survey the district officer estimates that the dredging and removal of ledge necessary to make the cove available for anchorage purposes will cost $158,400. For reasons stated in paragraph 11, the district officer is of opinion that Pepperells Cove is not worthy of improvement by the General Government, and in this opinion the division engineer concurs.

While the direct commerce of Pepperells Cove is practically nothing, no argument has been advanced in support of the desired improvement from the standpoint of its value to this commerce. The value of the improvement would be to the commerce of Portsmouth Harbor and to coastwise commerce, in connection with its use as a general harbor of refuge for light and moderate draft vessels. These find difficulty in securing a safe anchorage in the adjacent waters of Portsmouth Harbor, which are deep, congested, and subject to swift currents. As stated in its report on preliminary examination, the Board does not believe that the refuge obtainable at Little Harbor is suitable for this purpose.

The Board is of opinion that the cost of the dredging and removal of ledge is not excessive when compared with the resulting advantages to commerce and navigation. The present investigation of Pepperells Cove is "with a view to its deepening and the removal of a ledge." Under this enunciation the Board is of opinion that a breakwater at the entrance to Portsmouth Harbor can not properly be considered. Moreover, it is not convinced of the advisability of such a structure at this time. It believes that the improvement by dredging and removal of ledge should first be provided, and then if the necessity for a breakwater becomes apparent, further consideration should be given as to its location.

In view of the foregoing, the Board recommends the improvement of Pepperells Cove to the extent of the dredging and removal of ledge proposed by the district officer at an estimated cost of $158,400.

For the Board:

W. C. LANGFITT,
Lieut. Col., Corps of Engineers,
Senior Member Present.

STOCKTON HARBOR, MAINE.

Report on a recent survey is printed in House Document No. 1166, Sixtieth Congress, second session. Following is the report of the Board of Engineers, which is concurred in by the Chief of Engineers:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., November 16, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

In the report on the preliminary examination, and in the Board's indorsement of November 4, 1907, reviewing the same, an explanation was given of the development in progress at this locality, having for its purpose the establishment of a first-class port with improved facilities for the transshipment of commerce from rail to deep-

draft vessels and vice versa. In view of the importance of the interests involved, as indicated by the handling of over 600,000 tons of commerce during the fifteen months ending August 31, 1907, the Board recommended the authorization of a survey with a view to determining the cost of such improvement as may be properly undertaken by the General Government.

The survey having now been made, the district officer proposes to dredge a channel 300 feet wide and 25 feet deep at mean low water up to and in front of the established wharf lines on the Cape Jellison side of the harbor, as shown on the map, at an estimated cost of $38,000. In the opinion of the Board, the cost of the work proposed is small compared with the extensive benefits to be expected from the improvement. As indicated in the last paragraph of its indorsement on the report of preliminary examination, the Board desired to satisfy itself that these benefits would be sufficiently public in their nature to render the improvement of the harbor a proper work for the General Government to undertake.

The information on this question contained in the within report and appended papers indicates that all of the land suitable for terminal purposes at the harbor is owned and controlled by one railroad company, which charges tolls for the use of its wharves and piers. Under these conditions, rail transportation to and from Stockton Harbor will be in the nature of a monopoly, but the landing facilities will be available to all vessels at the rates prescribed. While the railroad company will derive much benefit from the improvement proposed to be made by the Government, the greatest benefit will accrue to the people served by this particular rail line, which has but recently been built through a rich but as yet largely undeveloped country the products of which have heretofore gone either to Canada or to Portland via rail lines having no competition. The opening of Stockton Harbor, with rail communication with this interior country, provides a competitive outlet which should result in maintaining favorable freight rates. For this reason, the Board believes that the public will be amply repaid for the small expenditure involved in constructing the proposed channel, and it concurs with the division engineer in recommending approval of the project presented by the district officer, at an estimated cost of $38,000, and $1,000 annually for maintenance.

SACO RIVER, MAINE.

In its original condition Saco River had a very winding course, with abrupt bends and narrows, which, with its sunken rocks and ledges, presented many difficulties of navigation. The depth on the bar was only 2 feet at mean low water.

The original projects appear to have been—

(1) From 1824 to 1827, for the erection of piers, placing beacons and buoys, and removing obstructions near the entrance to the harbor. Under this project 12 piers of timber and stone were built, 10 in the river to mark sunken rocks and to facilitate navigation by sailing vessels, and 2 outside the mouth designed, but without success, to create a channel through the bar. The construction and maintenance of these works cost, 1824–1827, $12,000.

(2) Adopted by the act of June 23, 1866, to construct a breakwater 2,915 feet long connecting the two outside piers, and to repair the river piers and improve the channel. Under this project, completed in 1874, the channel in the river and through the bar was improved, and a breakwater built on the north side of the channel 4,200 feet long and 10 feet high above mean low water, at an expense of $162,271.75.

The existing project is the consolidation by the act of September 19, 1890, of the project adopted in 1884 for repairing the breakwater, extending it 2,200 feet to Sharps ledge, building a stone jetty on the south side of the channel, and dredging between the jetties, at an estimated cost of $356,500; and the project adopted in 1886 for improving the river to Saco, 5 miles above its mouth, to the depth of 6 feet at mean low water, estimated to cost $50,000, amounting to $406,500.

About 43 per cent of this project has been completed, i. e., all except the extension of the breakwater to Sharps ledge, which is estimated to cost $200,000 and upon which no work has been done. In order to maintain the desired depth the extension of this breakwater will be necessary to stop the influx of sand from the north. Possibly the full extension proposed will not be required.

To June 30, 1909, there had been expended on the consolidated project $172,258.37. The depth on the bar at the mouth of the river is about 3½ feet at mean low tide. The depth of 6 feet in the river above appears to have been maintained.

The mean range of tides is 8.8 feet.

The head of navigation is at Saco and Biddeford, on opposite sides of the river, to which towns, about 5 miles above the bar, the river is navigable in fact. The stream above is devoted to water-power development and a small amount of lumbering.

The commerce for 1908 amounted to 44,074 tons, chiefly coal, of an estimated value of $216,517. The freight rates on coal are probably affected by the existence of water transportation, but it is believed that with a greater depth, permitting the use of larger vessels, a reduction in rates could be had which would operate to greatly increase the tonnage.

It is proposed to apply the appropriation recommended to extending the breakwater toward Sharps ledge, with the view of securing greater depth over the bar at the mouth of the river.

July 1, 1908, balance unexpended	$5,241.63
July 1, 1909, balance unexpended	5,241.63
Amount (estimated) required for completion of existing project	200,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	40,000.00

HARBOR AT ISLES OF SHOALS, MAINE AND NEW HAMPSHIRE.

Report on a recent survey is printed in House Document No. 1122, Sixtieth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 3, 1908.

SIR: I have the honor to submit herewith for transmission to Congress reports of September 6, 1907, and September 28, 1908, with map, by Lieut. Col. Geo. A. Zinn, Corps of Engineers, on preliminary examination and survey, respectively, authorized by the river and harbor act approved March 2, 1907, of Isles of Shoals, Maine and New Hampshire, with a view to the construction of a breakwater.

As early as 1821 Isles of Shoals claimed attention as a locality deserving of improvement, and about that time small stone walls were constructed which joined Cedar, Smuttynose, and Malaga islands and made a harbor of refuge of what is known as Gosport Harbor. In 1903–4 these walls were rebuilt as substantial breakwaters. Additional protection is desired and a plan is now presented which provides for building a breakwater between Cedar and Star islands at an estimated cost of $40,000.

It is expected that the further improvement proposed will provide a safe haven for the fishing fleet under nearly all conditions and occasionally for larger vessels in distress, and I concur in the opinion of the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors that the locality is worthy of further improvement to this extent.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

HARBOR AT BURLINGTON, VT.

Before improvement there was ample depth of water along the docks and wharves, but they were without protection against wind and seas from Lake Champlain. In the greatest exposure during the prevalent northwesterly gales the wind has a sweep obliquely across the lake of about 10 nautical miles.

The original project, adopted by the act of July 4, 1836, was to build a breakwater parallel with the shore and about 1,000 feet from the docks and wharves.

Under the original and modified projects the amount expended for construction prior to the adoption of the project of 1886 was $501,811.07, with which 3,551 feet of breakwater was built.

The existing project, adopted in 1886, is to extend the breakwater 1,500 feet (500 feet northerly and 1,000 feet southerly), at an estimated cost of $150,000; enlarged in 1894 and 1902 to embrace repairs and replacing the crib superstructure (4,157 feet) with one of stone or concrete, at a cost estimated at $173,750, a total of $323,750.

In the execution of this work it developed that through deterioration of the timber cribs the substructure on the lake face of the breakwater for a distance of 1,165 feet is in a serious condition as to stability. A rubble mound extending the full height of the substructure cribs, estimated to cost $52,000, should be built without delay to support and protect the lake face of the substructure.

Under the existing project there was expended to June 30, 1909, $238,261.34, of which $59,738.69 was applied to extending the breakwater 606 feet (364 feet northerly and 242 feet southerly), making the total length of the structure 4,157 feet. The remainder, $178,522.65, was applied to repairs and completing the rebuilding of 3,240 feet of superstructure, including $34,555 expended in repairing portions of the substructure thereunder, the necessity for which repairs could not be foreseen until the old superstructure was removed. From sales there was derived $146. The extension is 40 per cent and the rebuilding of the superstructure 78 per cent completed.

During the year 327 linear feet of concrete superstructure of the breakwater were built and repairs made to 124 linear feet of the foundation of the superstructure thereof.

The extreme variation of level of water surface is 6½ feet and the usual variation about 4 or 5 feet.

Of the appropriation asked for, $52,000 will be applied to the construction of a rubble protection for the substructure of a portion of the breakwater, and $34,555 to rebuilding the superstructure in accordance with the project of 1902. This latter sum was expended for repairs to the substructure or foundation, which had to be made prior to the erection thereon of said superstructure, and was defrayed from funds designed for continuing the rebuilding of the superstructure.

The commerce amounted in 1904 to 107,421 tons, and in 1908 to 249,174 tons, of which, in 1908, nearly 80 per cent was lumber.

A description of the existing project for repairs and maintenance may be found in the Annual Report of the Chief of Engineers for 1901, page 1072, and a description and history of the work in the Annual Report for 1897, page 3296.

July 1, 1908, balance unexpended	$32,993.90
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	27,754.24
July 1, 1909, balance unexpended	5,239.66
Amount (estimated) required for completion of existing project	124,555.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	86,555.00
Amount (estimated) required for completion of existing project:	
Improvement—Extension of breakwater 900 feet (project of 1886), balance	90,000.00
Maintenance (project of 1902)—Expenditures for repairs to substructure or foundation prior to rebuilding the superstructure	34,555.00
	124,555.00
Appropriation recommended for maintenance of improvement:	
Repairs to substructure already made (see preceding note)	34,555.00
Rubblestone protection for substructure	52,000.00
	86,555.00

HARBOR AT ST. ALBANS, LAKE CHAMPLAIN, VERMONT.

Report on a recent survey is printed in House Document No. 1109, Sixtieth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 4, 1908.

SIR: I have the honor to submit herewith for transmission to Congress report of November 25, 1907, by Lieut. Col. (then Major) Edward Burr, Corps of Engineers, on preliminary examination authorized by the river and harbor act approved March 2, 1907, of "Lake Champlain, to improve navigation in connection with the breakwater at Burlington, the channel known as 'The Gut' between Trombs Point, South Hero Island and Bow Arrow Point, and the harbor at Saint Albans;" also report of July 28, 1908, by Lieutenant-Colonel Burr, on survey of St. Albans Harbor, made in accordance with said act of March 2, 1907. All the localities considered in this connection are in the State of Vermont.

The breakwater at Burlington was built and the channel at "The Gut" dredged with funds appropriated by Congress. At the time the preliminary examination was made it appeared that improvement of these two localities beyond the requirements of existing projects was not necessary or desirable, and, under the law, no survey was made.

No work has been done at the harbor of St. Albans, and sufficient data not being available to determine whether any improvement should be undertaken, a survey was ordered, as provided by law. In his survey report Lieutenant-Colonel Burr recommends the removal to the level of the surrounding bottom of all bowlders and other obstructions having a depth over them of less than 6.5 feet at low lake level. The estimated cost of this work is $5,000.

I concur in the opinion of the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors that the harbor at St. Albans, Vt., is worthy of improvement by the General Government to the extent indicated.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

HARBOR AT BOSTON, MASS.

In its original condition the headlands and islands were without protection against the sea, which was extensively eroding them. Dangerous rocks obstructed the approach and entrance from Nantasket Roads to the lower main ship channel through the Narrows. That channel was 23 feet deep at mean low water, with a least width of 150 feet. The upper main ship channel from President Roads to Boston had a least depth of 18 feet at mean low water, with a least width of 100 feet. The channel from President Roads to Broad Sound in the ocean had a least depth of 29 feet at mean low water, with a least width of 200 feet.

The original project, adopted by the act of March 2, 1825, was "for the preservation of the islands in Boston Harbor, necessary to the security of that place," and until 1866 all expenditures, amounting to $546,526.10, appear to have been applied to that purpose in the building and repair of sea walls. The amount expended upon them since 1866 can not be accurately stated.

The project for the improvement of the harbor adopted by the act of March 2, 1867, was (as modified) to make the main ship channel from Nantasket Roads to Boston 23 feet deep at mean low water, 600 feet wide through the Narrows to President Roads, and 1,000 feet wide from President Roads to Boston.

To this project of improvement were added, from time to time, minor channels within or tributary to the harbor, since completed with allotments from the appropriation for Boston Harbor, known as Nantasket Beach channel, Nix Mate channel, Jeffries Point channel, Chelsea Creek, Charles River, and Fort Point channel.

Under the original project for sea walls and supplemental projects for the channels above named there has been expended for improvement and maintenance to June 30, 1909, $2,612,747.31, exclusive of all expenditures upon the five existing projects (three for the main channels and two for tributary channels), with which expenditure 3.75 miles of sea walls were built, protecting the most exposed headlands and islands, the subordinate channels described in the preceding paragraph (except Charles River) were completed, and a channel obtained 23 feet deep at mean low water from Nantasket Roads to Boston, with a least width of 625 feet in the Narrows and 850 feet between President Roads and the city. From sales of property $124.95 has been derived.

The expenditure for general improvement during past year was for engineering expenses in connection with contract for dredging in Fort Point channel.

The amount requested for general improvement will be applied to necessary repairs to sea walls and maintenance of improvements heretofore made in the tributary channels of the harbor.

The existing projects for improvement of the main channels are—

1. Adopted by the river and harbor act of July 13, 1892: To widen the main ship channel from Nantasket Roads to Boston to 1,000 feet and to deepen it to 27 feet at mean low water, at an estimated cost of $1,250,000, subsequently increased to $1,488,751. Project completed.

2. Adopted by the river and harbor act of March 3, 1899: To widen the Broad Sound channel to 1,200 feet and to deepen it to 30 feet at mean low water, at an estimated cost of $455,000. Project completed.

3. Adopted by the river and harbor act of June 13, 1902: To provide channels 35 feet deep at mean low water, 1,200 feet wide from the navy-yard at Charlestown and the Chelsea Bridge and Charles River Bridge to President Roads, and 1,500 feet wide from President Roads through Broad Sound to the ocean, at an estimated cost of $7,994,000 in round numbers. This estimate differs from any made in the project quoted in the act as the basis of the appropriation, owing to the different width of the channels adopted. (To avoid a large amount of rock excavation the 35-foot channel from President Roads to Broad Sound is in a different location from the 30-foot channel.)

Under the project of July 13, 1892, to June 30, 1909, the amount expended was $1,472,606.29, of which $58,215.30 was for maintenance and $10 derived from sales. With the total amount expended under this project the upper and lower main ship channels from Boston to President Roads and from President Roads to the sea have been dredged to the width of 1,000 feet and depth of 27 feet at mean low water. In the upper main ship channel the full width and depth are available. In the lower main ship channel the available width of the 27-foot channel is contracted by shoals to 650 feet. The maximum draft that can be carried at mean low water, June 30, 1909, over the shoalest part of the locality under improvement is 27 feet. A map of the project is in the Annual Report of the Chief of Engineers for 1894, page 554.

Under the project of March 3, 1899, to June 30, 1909, the amount expended was $385,200, all for improvement, with which a channel 1,200 feet wide and 30 feet deep at mean low water was dredged from President Roads to Broad Sound, embracing the dredging of 965,383.9 cubic yards of sand, gravel, and clay and 198.864 cubic yards of bowlders, and the removal of 156 cubic yards of ledge. The maximum draft that can be carried at mean low water, June 30, 1909, over the shoalest part of the locality under improvement is 30 feet. The project is published in Annual Report of the Chief of Engineers for 1898, page 886.

Under the project of June 13, 1902, continuing contracts to the amount of $3,600,000 were authorized by the act of that date, and pursuant thereto a channel of the full projected depth, but 540 feet wide, from the navy-yard, Charles River Bridge, and Chelsea Bridge to President Roads, and 675 feet wide from President Roads through Broad Sound to the ocean, was begun in 1903 and is now nearing completion. By the act of March 2, 1907, Congress authorized the completion of the 35-foot channel to the full projected widths, appropriating $500,000 for the purpose and authorizing contracts to the amount of $3,894,000 additional, of which $2,694,000 remains to be appropriated. Under this authorization a single contract for all the dredging required to complete the channel has been let and work was begun on October 28, 1907. Contracts for rock excavation will be let from time to time as ledge may be uncovered by the dredging.

PROJECT FOR GENERAL IMPROVEMENT.

July 1, 1908, balance unexpended		$75,079.23
Receipts from sale		2.70
		75,081.93
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$14.33	
Carried to surplus fund	20,000.00	
		20,014.33
July 1, 1909, balance unexpended		55,067.60
July 1, 1909, outstanding liabilities		4,720.15
July 1, 1909, balance available		50,347.45
July 1, 1909, amount covered by uncompleted contracts		534.26
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		[a] 75,000.00

GLOUCESTER HARBOR, MASSACHUSETTS.

Report on a recent survey is printed in House Document No. 1112, Sixtieth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 4, 1908.

SIR: I have the honor to submit herewith for transmission to Congress reports of October 24, 1907, and October 31, 1908 (with map), by Lieut. Col. Edward Burr, Corps of Engineers, on preliminary examination and survey, respectively, authorized by the river and harbor act approved March 2, 1907, of Gloucester Harbor, Massachusetts, with a view to removing ledges.

Gloucester Harbor has been improved since 1872 under successive projects providing for dredging, rock removal, and the construction of a breakwater.

The additional work now proposed is the removal to the depths named of certain ledges specified in the survey report of October 31, 1908, at an estimated cost of $51,000.

I concur in the opinion of the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors that Gloucester Harbor is worthy of further improvement by the United States to the extent indicated.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

In the outer harbor the removal is desired of Round Rock, Babsons Ledge, and several points in the vicinity of Tenpound Ledge on the east and west sides of the harbor. In the inner harbor complaint is made of obstructions off various wharves that hamper access thereto or obstruct the channel at low water, to the inconvenience of fishermen, steamers, and other vessels frequenting the port.

The harbor of Gloucester is the most important port between Boston and Portland, and is the headquarters of a large section of the New England fishing fleet, besides having a general commerce of some importance. By reason of its location on the southerly side of Cape

[a] At the time this estimate was prepared and submitted to the Secretary of War it was expected that certain balances of appropriations for improvement of Boston Harbor would necessarily be covered into the surplus fund of the Treasury under the requirements of section 10 of the sundry civil act approved March 4, 1909. These balances having been retained under authority of joint resolution approved June 25, 1909, this estimate may now be reduced to $25,000 without detriment to the work involved.

Ann, the projecting northerly point of Massachusetts Bay, it is also a port of refuge, furnishing shelter in the outer harbor in all but southerly storms and in the inner harbor in all weathers for vessels drawing not more than 15 feet. In 1906 its commerce amounted to 275,888 tons, of a value of $15,536,301, of which the largest items in value are fish and fish products. This commerce shows a normal and healthy condition since 1899, prior to which date no reliable statistics are available.

HINGHAM HARBOR, MASSACHUSETTS.

In its original condition the channel leading to Hingham, south of Ragged and Sailor islands, was very narrow and crooked and obstructed by sunken rocks and shoals, over which the least depth was 4 feet at mean low water, while the available width of channel was but 30 feet.

The original project, adopted by the act of March 3, 1875, was to widen and deepen the natural channel by dredging and blasting to the width of 100 feet and depth of 8 feet at mean low water from deep water near the head of the harbor to the steamboat wharf, a distance of about 2,500 feet, at an estimated cost of $11,000. This improvement was completed in 1884, with the expenditure of $9,316.58, all for improvement, allotted from the appropriation for improving harbor at Boston, Mass.

The existing project, adopted by the act of August 5, 1886, and completed in 1893, is to deepen the improved channel 100 feet wide to 10 feet at mean low water and remove a mid-channel ledge, in the lower channel between Chandlers and Ragged islands, at an estimated cost of $18,750. By the act of March 2, 1907, without previous estimate, $10,000 was appropriated for redredging the channel, and by the river and harbor act of March 3, 1909, the unexpended balance of this appropriation was "made available for redredging and improving the channel."

In accordance with the desire of local commercial interests, active steps toward the application of this appropriation have been suspended awaiting action by Congress to make the funds available for extension instead of maintenance and improvement of channel heretofore improved.

To June 30, 1909, $19,327.72 (including $327.72 for maintenance) has been expended under the existing project.

The maximum draft that can be carried June 30, 1909, over the shoalest part of the locality under improvement is 8½ feet at mean low water. The mean range of tides is 9.5 feet.

The commerce benefited by the improvement consists of coal and building materials, of which 12,370 tons was received during the calendar year 1908, slightly less than the freight reported received in 1883; but the line of Boston passenger steamers which at the time the improvement was made landed at the pier ot the head of the improved channel has long since been discontinued.

The original project, with survey of the harbor, is in the Annual Report, Chief of Engineers, for 1875, Part 2, page 417. A report of the survey upon which the present project is based is in the Annual Report for 1885, page 555, and a map of the harbor in the report for 1888, page 456.

July 1, 1908, balance unexpended	$9,672.28
July 1, 1909, balance unexpended	9,672.28

Report on a recent survey of Hingham Harbor is printed in House Document No. 355, Sixty-first Congress, second session.

Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, September 15, 1909.

SIR: I have the honor to submit herewith for transmission to Congress report of July 8, 1909, by Lieut. Col. Edward Burr, Corps of Engineers, on preliminary examination of Hingham Harbor, Massachusetts, authorized by the river and harbor act approved March 3, 1909.

Hingham Harbor has been improved by the United States with a view to securing a channel 100 feet wide, first 8 and then 10 feet deep at mean low water, together with the removal of certain dangerous ledges.

The river and harbor act approved March 2, 1907, appropriated the sum of $10,000 for redredging this channel, and the act approved March 3, 1909, made these funds available "for redredging and improving the channel." It appearing, however, that what is necessary and actually desired by the local interests is an extension of the channel westward rather than additional improvement of the existing channel, the funds available in this case are being held to await the further action of Congress which will permit of such extension.

As a result of the present investigation the local officer is of the opinion that Hingham Harbor is not worthy of improvement by the United States to a greater extent than can be accomplished with the balance of funds now on hand and available, and that this balance can be most advantageously employed in redredging the existing channel and extending the same westward toward the wharves in the upper part of the harbor, the depth throughout to be made 8 feet at mean low water and the width as great as the funds available will allow.

This opinion is concurred in by the Board of Engineers for Rivers and Harbors, and I recommend that provision be made for the application of available funds as proposed.

The local officer further recommends that expenditure of these funds as proposed be authorized upon condition that the State of Massachusetts or other local authority assume the further improvement and maintenance of this channel. In my opinion the question may properly be left for Congress to determine whether application of the funds in the manner proposed shall be made subject to the restriction named.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

LYNN HARBOR, MASSACHUSETTS.

Following are extracts from House Document No. 948, Sixtieth Congress, first session, relating to a recent survey:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, May 15, 1908.

SIR: I have the honor to submit herewith for transmission to Congress reports of October 24, 1907, and March 13, 1908, by Lieut. Col. Edward Burr, Corps of Engineers, on preliminary examination and survey, respectively, authorized by the river and harbor act approved March 2, 1907, of Lynn Harbor, Massachusetts, "with a view to obtaining a turning basin five hundred feet square and fifteen feet deep, straightening the present channel, and making a channel three hundred feet wide and fifteen feet deep from deep water to wharves at head of harbor."

Lynn Harbor is at present being improved under a project which provides for securing a channel 200 feet wide and 15 feet deep at mean low water, with a basin at the inner end 500 feet by 300 feet and of the same depth, and the present investigation has for its object the widening of the basin and the widening and straightening of the channel, as indicated by the language above quoted. The additional dredging required is estimated to cost $179,000.

I concur in the opinion of the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors that this locality is worthy of further improvement by the United States in the manner proposed.

Very respectfully,

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

In 1882, at the commencement of the improvement, the population of Lynn was nearly 40,000; its water-borne commerce was approximately 150,000 tons per annum, of which 102,000 were coal. The value of this commerce was estimated at $827,000; the number of entrances and clearances of vessels, foreign and coastwise, was 589, of a tonnage of 99,569, or an average of 160 tons. The growth of the city and port has been steady and healthy until in 1906 the population was 77,000 and the water-borne commerce was 343,784 tons, of which 263,000 tons were coal. The value of this commerce was $14,092,313. The entrance and clearances of all vessels in 1905 numbered 4,970.

Lynn is a manufacturing city of importance and receives direct by water a large part of its coal and some other bulk freight. In so far, however, as concerns general merchandise it is tributary to the land and water transportation lines centering at Boston. The desire of local commercial interests is for such an improvement of the channel as will permit of better and more regular water connection with Boston, where advantage may be taken of deep-sea water routes, particularly of coastwise lines to the southward, and as will permit ultimately of local coastwise lines direct to other ports. With the congestion in recent years in rail freights and with the delays resulting therefrom, there follows an increased desire and necessity for the development of such water routes as will relieve this congestion and furnish quicker as well as cheap transportation to ports of export and to the centers of distribution on the coast to the southward.

HARBOR OF REFUGE AT NANTUCKET, MASS.

This harbor is the only one between the harbors of Marthas Vineyard (Vineyard Haven and Edgartown) and Provincetown, a distance of 100 miles, except the small harbor of Hyannis, on the north side of Nantucket Sound. It has a considerable area, with a depth of water in excess of 12 feet, and the object of the improvement is to make it a harbor of refuge for vessels plying between ports north and south of Cape Cod. Incidentally it forms a commercial harbor for the island of Nantucket, and it is the only one on the island. So far as known it has never been used to any extent as a harbor of refuge.

In its original condition the channel entrance was obstructed by a bar 1.5 miles in width, on which there was only 6 feet of water at mean low tide, the channel being very crooked and subject to changes in location. Between 1829 and 1844 an ineffectual attempt was made to dredge a channel through the bar; $45,734.75 was expended prior to beginning operations under the existing project.

The present project, adopted in 1880 and modified in 1885, provides for the construction of two jetties, one on each side of the entrance, and for dredging when necessary in order to obtain a channel depth of from 12 to 15 feet at low water. Estimated cost, $375,000, exclusive of cost of dredging.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1909, exclusive of outstanding liabilities, was $387,823.48, of which $7,210 was expended in repairs to the west jetty, $6,312.90 to the east jetty, and $50,000 in dredging.

About 79 per cent of the whole project has been completed. No works of improvement or maintenance have been in progress during

the fiscal year. The expenditures were for survey, care of property, and collection of commercial statistics.

About 83 per cent in length of the west jetty and 90 per cent of the east jetty have been constructed. A channel 200 feet wide and 12 feet deep at mean low water was dredged between the jetties during the working season of 1905.

The mean rise and fall of the tide is about 3 feet. During an unusually severe storm in December, 1896, a breach was made through the Haulover Beach between the ocean and the head of the harbor. The breach remained open until the spring of 1909, when it closed from natural causes.

A survey of the jetty channel made in June, 1909, shows that considerable scour has taken place throughout most of the dredged channel, but that a bar about 400 feet wide has formed just outside of the end of the east jetty over which there is a minimum depth of 10.7 feet, which is now the greatest depth that can be carried into the harbor at mean low tide.

A large portion of the 3,955 feet of the west jetty, built prior to 1884, has been damaged somewhat by storms and ice and, having no core of small stone, allows considerable sand to pass through it. This should be repaired so as to be as sand tight as possible and raised to its original height. It is estimated that $30,000 will be required to complete the repairs in addition to the estimated cost of the project.

The approved project for this work contemplates building two converging jetties and the excavation by dredging of so much of the channel as may not be deepened by the tidal scour. The estimate of the cost of the approved project was $375,000 for the jetties alone. But the height above low water was left to be determined by experience, and it will be some years before the work can be considered as complete. Owing to the exposed situation, the character of the bottom, and the effect of ice, $13,522.90 of the appropriation for construction is properly chargeable to maintenance, for which no special allotment was made. Dredging, which was included in the project but not in the estimate, had been postponed year by year to observe the action of the jetties, but $50,000 for the purpose of dredging was first applied from the appropriation of March 3, 1905. The dredged channel, now about 200 feet wide and 12 feet deep at mean low water, should be increased in width from the deep water off Brandt Point in the inner harbor to the deep water outside the jetty entrance, and the estimate for completion includes $50,000 for that purpose, making a total increase in the estimated cost of $100,000 on account of dredging.

Further work under the project will consist in raising the incomplete portions of both jetties as may be required, and deepening and widening the dredged channel, with a view to the extension and maintenance of the benefits to be derived from the improvement. It is proposed to apply the amount estimated as a profitable expenditure to deepening and widening the channel by dredging and to enlarging and strengthening such portions of the jetties as may be necessary.

The entire commerce of Nantucket is carried on at this harbor, amounting in 1908 to about 26,840 tons, valued at $1,000,600, consisting largely of general merchandise, lumber, coal, forage, grain and live stock.

The effect of this work will be to afford a place of refuge easy of access and free from storms for coasters and fishing vessels.

Amount (estimated) required for completion of existing project..... $101,312.90
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909..... 80,000.00

HARBORS OF NEW BEDFORD AND FAIRHAVEN, MASS.

New Bedford Harbor is an estuary of Buzzards Bay, at the mouth of the Acushnet River, the Fairhaven side of the harbor being called "Fairhaven Harbor."

Before improvement the channel had a depth of 12.5 feet at mean low water. The improvement of this harbor has been carried on under a number of distinct projects, the first being the removal of a wreck and dredging the sand bar formed by it in 1836–1839, on which $10,000 was expended. The projects of 1874 and 1877 provided for a channel 300 feet wide and 15 feet deep at mean low water from the deep water just above Palmers Island to the wharves of New Bedford. This work was completed in 1877 at a cost of $20,000.

This was followed after 1887 by various projects in which the controlling depth was 18 feet at mean low water and comprised channels 200 feet wide from Buzzards Bay to New Bedford, about 150 feet wide along the city wharf front above and below the New Bedford and Fairhaven bridge, an anchorage area about one-half mile long and 600 feet wide on the northerly side of the main channel between New Bedford and Fairhaven, and a channel 250 feet wide leading from the anchorage area through the draw in the bridge to the wharves above, with a turning basin above the bridge. The total cost of the 18-foot projects, which were completed in 1906, was $137,709, making a total of $167,709 expended prior to the adoption of the existing project.

The existing project was adopted by the river and harbor act of March 2, 1907, and provides for dredging channels 25 feet deep at mean low water, 300 feet wide from Buzzards Bay to the north end of Fish Island, just above the New Bedford and Fairhaven bridge, with a turning basin above the bridge, and an anchorage area of about 114 acres, 25 feet deep, between New Bedford and Fairhaven, at an estimated cost of $527,000. An appropriation of $100,000 was made and contracts authorized in the additional sum of $200,000, which has since been appropriated for prosecuting the work. Section 3 of the river and harbor act approved March 3, 1909, contained the following provision modifying the project of 1907:

Improving harbors of New Bedford and Fairhaven, Massachusetts: The authorization for the improvement of said harbors contained in the river and harbor act of March second, nineteen hundred and seven, is hereby extended so as to include the extension of the basin north of Fish Island, now being dredged under the adopted project, southward between the harbor lines to the bridge beween New Bedford and Fish Island, and the extension of the twenty-five foot channel along the New Bedford front from its terminus, as contemplated by the present project, northerly between established harbor lines to said bridge: *Provided*, That a contract or contracts for such improvement can be made within the limit of cost authorized by the said act of March second, nineteen hundred and seven.

At the adoption of the existing project 18 feet depth of water was available for vessels to reach the wharves of New Bedford, but the

channel was too narrow, the anchorage small, and the depth insufficient to accommodate the commercial demands of the port.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1909, was $273,850.33, exclusive of outstanding liabilities, by which the work of dredging under a continuing contract was continued throughout the fiscal year. The turning basin and channel above the drawbridge and the channel leading from the anchorage area to the drawbridge for a width of about 200 feet have been practically completed; a considerable portion of the anchorage area has been deepened to 25 feet, and a channel 135 feet in width has been dredged from Buzzards Bay to the anchorage area, but both the dredged portion of the anchorage area and the latter channel contain shoals still to be removed.

About 23½ feet of water at mean low tide can now be carried from Buzzards Bay through the harbor to the drawbridge, about 3 miles, and to the harbor line below the bridge. Through the bridge about 18 feet can be carried, and 25 feet from the bridge through the turning basin, about 0.2 mile. A farther distance of about 2 miles up the Acushnet River is navigable, with a natural depth of from 6 to 15 feet of water.

It is proposed to apply the amount estimated as a profitable expenditure to the widening and deepening of the channel and enlarging the anchorage area by dredging to the full projected dimensions. The additional work proposed is in part necessary to make the improvement available and also for the extension of benefits.

The commerce of the harbor in 1908 amounted to about 1,511,885 tons, consisting mostly of coal, building materials, general merchandise, and cotton, valued at $41,091,124.

The effect of the deep water on commerce is the use of deeper draft vessels than formerly, larger cargoes, and a consequent reduction in water freight charges.

For reference to reports containing more detailed information, see Annual Report of the Chief of Engineers for 1905, page 81.

The report of the survey of New Bedford and Fairhaven harbors, dated May 18, 1906, upon which the existing project is based, is printed as House Document No. 271, Fifty-ninth Congress, second session.

July 1, 1908, balance unexpended	$209,789.05
June 30, 1909, amount expended during fiscal year for works of improvement	183,639.38
July 1, 1909, balance unexpended	26,149.67
July 1, 1909, outstanding liabilities	18,978.62
July 1, 1909, balance available	7,171.05
July 1, 1909, amount covered by uncompleted contracts	3,621.83
Amount (estimated) required for completion of existing project	227,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	227,000.00

NEWBURYPORT HARBOR, MASSACHUSETTS.

Prior to specific appropriations for Newburyport Harbor funds applicable to Merrimac River, of which it is the estuary, were devoted to removing a sand bar and constructing a breakwater at the river's mouth, 1828 to 1836, and to removing obstructing ledges,

piers, and wrecks, 1870 to 1880. In its original condition the outlet of the Merrimac River, which between Plum Island and Salisbury Point was 1,000 feet wide and 30 feet deep at mean low water, was obstructed by a sand bar, nearly a mile outside, through which, in 1880, a narrow channel about 7 feet deep at mean low water was maintained by the current of the river.

The original project adopted by the act of June 14, 1880, which is the existing project, is to create at the outer bar a permanent channel, 1,000 feet wide and at least 17 feet deep at mean low water, by constructing two converging jetties, projecting, one from the north shore 2,910 feet, the other from the south shore 1,500 feet, their outer ends 1,000 feet apart, which, with the protection of the beach in their vicinity, was estimated in 1881 to cost $365,000. The direction of jetties and shore protection was modified in 1883, and in 1882 the partial closing of Plum Island Basin with a timber dike about 800 feet long and 5½ feet above mean low water was added to the project, increasing the cost (as estimated in 1884) to $375,000. In 1884 a modification of the project provided for extending both jetties 610 feet parallel to the axis of the channel, and in 1886 for increasing that extension to 1,000 feet, increasing the cost of the work, as estimated in 1897, to $599,547.49.

To June 30, 1909, the amount expended on this project was $396,652.79, of which $9,379.66 was for maintenance. In addition, $500 was expended in 1901 for removal of North rock under authority of act of March 3, 1899. The expenditure for maintenance in the fiscal year 1909 ($1,557.87) was applied to retopping the outer end of the north jetty. By way of refundment, $795.31 was recovered from a failing contractor.

With the expenditure for improvement, the north jetty has been completed for a total length of 2,868 feet and the south jetty completed except for a distance of 30 feet at its outer end; the Plum Island Basin has been closed with a timber dike 817 feet long, 5½ feet high above mean low water, except near the middle, where a weir 150 feet long and 2 feet above mean low water was left temporarily; and two sand catchers, respectively 480 and 572 feet in length, have been built in rear of the south jetty. Both jetties are 15 feet wide on top, which is in a plane 12 feet above mean low water, and have slopes of 1 on 2 on the seaward face and 1 on 1 on the shoreward face. The project is about 80 per cent completed.

June 30, 1909, the maximum draft that can be carried over the bar at mean low water is 12 feet. The mean range of tides is 7.7 feet.

The commerce of the harbor, chiefly coal, amounted in 1907 to 209,896 tons, and in 1908 to 251,239 tons. Of the latter amount 113,840 tons were reshipped to points on the Merrimac and Powow rivers.

It is reported that the improvement made has reduced freight rates 25 cents per ton, and that if the projected depth of 17 feet at mean low water be obtained over the outer bar it would still further reduce the freight rates 15 to 25 cents per ton.

The amount estimated as a profitable expenditure in the fiscal year ending June 30, 1911, will be applied to the further extension of the north jetty.

The original project as reported by a board of engineers, with map of the harbor, is published in Annual Report of the Chief of

Engineers for 1881, page 502; the modifications in jetties and shore protection, in reports for 1883, page 437, and 1884, page 494; the parallel extension of the jetties, with map and additional estimate, in report for 1897, page 825, and a survey of the bar and entrance, in report for 1905, page 802.

A survey and map of the bar and entrance, with estimate for removing obstructions in the mouth of the river, are published in House Document No. 339, Fifty-ninth Congress, second session.

July 1, 1908, balance unexpended		$14,781.21
Amount recovered from failing contractor		795.31
		15,576.52
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$11,876.13	
For maintenance of improvement	1,557.87	
		13,434.00
July 1, 1909, balance unexpended		2,142.52
Amount (estimated) required for completion of existing project		209,369.28
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909		75,000.00

HARBOR OF PLYMOUTH, MASS.

In the original condition of the harbor the channel and low-water line were about 2,500 feet from the wharf at Plymouth. Long Beach, between the harbor and the ocean, was, for the most part, low and narrow, and liable to inroads by the sea that would injure or destroy the harbor.

All projects and expenditures prior to 1875 appear to have been for the construction of works for the preservation of the beach.

The original project for the improvement of the channel, adopted by the act of March 3, 1875, was to dredge a channel, 100 feet wide and 6 feet deep at mean low water, through the flats from the channel in the inner harbor to Long Wharf in Plymouth, at an estimated cost of $28,000.

Prior to operations under the existing project, $198,859.22 had been expended in preserving Long Beach and in dredging under the project of March 3, 1875, as modified, which resulted in obtaining a channel 150 feet wide and 9 feet deep and a basin directly in front of the town wharves 866 feet long, 150 feet wide, and 9 feet deep. Of this amount $60,727.52 was expended for maintenance.

The existing project for the protection of the beach, adopted by the act of March 3, 1899, is to strengthen the sections of beach damaged by the great storm of November, 1898, and to restore Eel River to its former course, discharging into the head of the harbor, from its course into the sea, to which it was changed by the storm. The estimated cost was $95,700.

The amount expended on the work of improvement under the existing project to the close of the fiscal year ending June 30, 1909, is $73,437.28, with which 11,843 linear feet of rubblestone dike was built on Long Beach, which has resulted in strengthening the beach by the accretion of a large volume of sand and beach shingle; Eel River was restored to its former course, and 536 linear feet of stone dike was built to prevent the river from being again turned into the sea. In addition to the aforesaid amount expended under the present project,

$3,954.42 has been expended for maintenance in redredging the turning basin, which had been dredged at the wharves under the project of March 3, 1875.

By way of refundment, $4,530.12 was collected as damages from the surety of a failing contractor.

In the report of January 20, 1899, submitting the project with estimate of cost, it was said:

> The following estimate for this work should be considered approximate only, for the reason that further changes are likely to occur before the work can be accomplished, which changes may materially increase or diminish the amount of work necessary to restore the beach to a safe condition.

The accretion of the beach before the stone dike was built materially diminished the cross section of a considerable part of it, and permitted its extension to protect other places where further erosion has occurred.

It is proposed to apply the appropriation recommended to maintenance of improvement.

The commerce consists chiefly of coal and lumber, of which 33,354 tons was received in 1906 and 39,860 in 1908.

It is reported by the harbor master at Plymouth that the improvement of this locality by the United States has effected a saving of 50 cents per ton in freight rates.

The maximum draft that can be carried, June 30, 1909, at mean low water, over the shoalest part of the locality under improvement is 7.5 feet.

The town of Plymouth at its own expense has undertaken to restore and deepen to 10 feet at mean low water the channel and basin completed by the Government.

The mean range of tides is 10.1 feet.

Reports of examination and survey, with a view to the construction of a rubblestone breakwater from Long Beach along the crest of Browns Island, are printed, with map, in House Document No. 1168, Sixtieth Congress, second session.

July 1, 1908, balance unexpended	$8,270.94
July 1, 1909, balance unexpended	8,270.94
Amount (estimated) required for completion of existing project	20,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance or improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

HARBOR AT PROVINCETOWN, MASS.

This is an important harbor of refuge in the bight at the extremity of Cape Cod.

In its original condition the width and depth of its entrance and the depth of its anchorage were ample for the largest vessels, but actual or threatened inroads by the sea across the low and narrow part of the cape east of the town, and at intervals along about 1½ miles of the narrow beach southwest of the town, were a serious menace to the harbor.

The original project, adopted by the act of May 20, 1826, was "for the preservation of the point of land forming Provincetown Harbor"

The project from 1826 continuously to this date has been, by building dikes and groins and by other sand-catching devices, to arrest the erosion and promote the accretion of the barrier of beach and sand dunes which protects and preserves the harbor.

Work during the past year consisted in extending southerly the bulkhead at Abel Hill dike a distance of 48 feet; minor repairs to the bulkhead were also made.

The amount expended to June 30, 1909, is $215,395.99, all applied to improvement.

The preservation of the harbor, whose importance as a harbor of refuge requires no elaboration, depends upon the maintenance of the barrier from Abel Hill to Long Point as a protection against westerly and southwesterly seas. Since the commencement of the improvement it has been sought to maintain this barrier by means of timber structures of temporary character, designed to catch and hold the sand moved by the sea and wind. Although in the vicinity of and below Wood End they have been partially successful in accumulating sand moved by the wind, for the greater part of the distance between Abel Hill and Wood End they have failed in the long run to accomplish their purpose, and now for a considerable part of this distance there exists between the ocean and the harbor only a light, sand-filled, wooden bulkhead, built on the beach whose crest is below the level of spring tides. The failure of these works may be attributed to absence of any great quantity of wind-driven sand and to the inability of light timber structures to withstand the inroads of the sea. As a result of storms of recent winters, a portion of the beach is now in such a condition that temporary expedients can not be relied upon or expected to hold it through another winter of average westerly storms. For the security of the harbor a rubblestone dike is required across House Point Island flats from the vicinity of Stevens Point to a point northeasterly from Wood End light, as shown in a general way on the map at page 576 of the Annual Report of the Chief of Engineers for 1886, estimated to cost $135,000, and to this purpose the appropriation asked for will be applied. It is recommended that provision for the entire work be made at one time, either by a single appropriation or by the continuing-contract system.

The maximum draft that can be carried to the anchorage is ample for the largest vessels.

The balance available will be applied to works of protection for preserving and strengthening the beach that preserves the harbor.

The commerce of this port is a small factor in this improvement compared with the preservation of this very excellent and important harbor of refuge.

July 1, 1908, balance unexpended	$7,167.13
June 30, 1909, amount expended during fiscal year, for works of improvement	400.15
July 1, 1909, balance unexpended	6,766.98
July 1, 1909, outstanding liabilities	5.43
July 1, 1909, balance available	6,761.55
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	135,000.00

HARBOR OF REFUGE, SANDY BAY, CAPE ANN, MASSACHUSETTS.

In its original condition this bay, whose southerly shore extends about 2 miles westerly from the point of Straitsmouth Island, and thence about 2 miles northerly to Andrews Point, had a good holding ground of sand mixed with mud, and a depth of 7½ to 15 fathoms at mean low water, but was fully exposed to easterly, northeasterly, and northerly gales. The original project, adopted by the act of July 5, 1884, was to build a breakwater consisting of a mound of rubblestone to the grade of 22 feet below mean low water, 40 feet wide on top, to be surmounted by a masonry wall, and to extend from Averys ledge a little west of north 3,600 feet to Abners ledge, thence 5,400 feet northwesterly in the direction of Andrews Point, covering an anchorage of about 1,377 acres.

This project, with the cross section of the breakwater as modified by a Board of Engineers February 13, 1900, is the existing project, the breakwater to consist of a mound of rubblestone built to the grade of 12 feet below mean low water, where it will have a width of 117 feet, its harbor slope to be 1 on 1, its seaward slope 1 on 1 up to 25 feet below mean low water, and 1 on 2 thence to the top, 12 feet below mean low water; the rubble mound to be surmounted with a core of rubblestone, to be faced with selected stone to be laid horizontally on the sea face, to weigh not less than 8 tons each and to be laid with a batter of 1 on 2, and on the harbor face to weigh not less than 3 tons each and be laid with a batter of 1 on 1; to be surmounted at grade 17 feet above mean low water with a single course of capstones, whose upper surface shall be 22 feet above mean low water; at an estimated cost (as revised in 1900) of $6,904,952.25.

The river and harbor act of March 2, 1907, authorized a continuing contract for this work to the extent of $100,000 in excess of the appropriations then made. This sum has since been appropriated.

The amount expended under the existing project to June 30, 1909, not including outstanding liabilities, is $1,587,918.01, all for improvement. From sale of property $1 was derived. With this expenditure 2,052,935 tons of rubblestone has been placed in the substructure of the breakwater, and its condition is approximately as follows:

In the southern arm for a length of 3,530 feet the mound of rubblestone has been completed up to the grade of 12 feet below mean low water, with the full width of 117 feet prescribed in the project; the rubble core of the superstructure has been built to the height of mean low water, 2,990 feet, and to the height of 5 feet above mean low water for 540 feet farther.

In the western arm for a length of 2,500 feet from the angle the mound of rubblestone has been likewise completed to the full height (12 feet below mean low water) and full width (117 feet) projected, except for a small bench on the inner slope 13 feet deep and 17 feet wide; a rubble core of the superstructure has been built to the height of mean low water for 2,100 feet and to the height of mean high water for 400 feet.

The superstructure on the southern arm of the breakwater was commenced in 1908 and at the close of the working season of that year had been completed for a distance of 97 feet, extending in a northerly direction toward the junction with the western arm. Although no storms occurred of unusual severity, an examination made at the

close of the winter season disclosed evidences of insufficiency of the superstructure built in accordance with the approved plan, the stone in the lower courses of the wall having been drawn outward. By authority of the Chief of Engineers the construction of a new section 300 feet in length has been undertaken, in which the superstructure will be built up to the grade of mean low water, where it will have a width of 81 feet, its harbor slope to be 1 on 1, its seaward slope 1 on 1 up to 25 feet below mean low water, and 1 on 2 to the top at mean low water; the rubble mound to be surmounted with a core of rubblestone, to be faced with selected stone to be laid horizontally on the sea face, to weigh not less than 8 tons each and to be laid with a batter of 1 on 1, and on the harbor face to weigh not less than 3 tons each and be laid with the same batter; to be surmounted at grade 17 above mean low water with a single course of capstones, whose upper surface shall be 22 feet above mean low water; the seaward face to be protected with an apron of heavy rubblestone to the height of mean high water, with a slope of 1 on 2.

Of the quantity of rubblestone required in the substructure, 41 per cent has been deposited, which is approximately 31 per cent of the quantity required for both substructure and superstructure.

The depth of water is ample for the largest vessels; the mean range of tides is 8.6 feet.

The appropriation recommended will be applied to extending the superstructure of the breakwater.

The improvement is chiefly of value in providing refuge for coastwise vessels, especially towed barges, which are frequently and suddenly in urgent need of shelter in fog and snowstorms.

For description of Sandy Bay and original project, see Annual Report of the Chief of Engineers for 1884, pages 565–577. For cross section, details of construction, and increase in cost, see report of Board of Engineers, Annual Report for 1900, page 1186.

July 1, 1908, balance unexpended	$213,828.44
Amount appropriated by sundry civil act approved March 4, 1909	75,000.00
	288,828.44
June 30, 1909, amount expended during fiscal year, for works of improvement	126,745.45
July 1, 1909, balance unexpended	162,082.99
July 1, 1909, outstanding liabilities	5,166.76
July 1, 1909, balance available	156,916.23
July 1, 1909, amount covered by uncompleted contracts	131,802.50
Amount (estimated) required for completion of existing project	5,154,952.25
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	500,000.00

MERRIMAC RIVER, MASSACHUSETTS.

In its original condition the Merrimac River had a practicable channel 7 feet deep at mean low water from its mouth 9 miles to South Amesbury, but besides being narrow and crooked the channel was obstructed by ledges, bowlders, and shoals.

The original projects appear to have been—

(1) For improving the bar at the mouth of the river, by erection of piers or other works, adopted by act of May 23, 1828; subsequently

improved under separate project for "Improving harbor at Newburyport, Mass."

(2) For the improvement of the river above the mouth, by the removal of the remains of a dam at the upper falls and of a rock at the lower falls, of Gangway rock in Newburyport Harbor, and a wreck near the mouth of the river.

Upon the original and modified projects, prior to operations under the existing project, there were expended: Upon the project of 1828, $67,466.72, and upon the project of 1870, as largely extended by the acts of June 23, 1874, and June 3, 1896, $187,000; total, $254,466.72.

The existing project, adopted by the act of March 3, 1899, is to obtain a channel 7 feet deep at mean low water, 150 feet wide, from Newburyport 14½ miles to Haverhill, at an estimated cost of $171,442.70.

The amount expended on the existing project to June 30, 1909, is $117,989.48, of which $2,564.71 was applied to maintenance of improvement, and 10 cents derived from sales. With this expenditure the channel has been completed to the full projected depth and width.

The commerce of the river is chiefly in coal distributed to the cities and towns along its banks, and amounted in 1907 to 98,442 tons, and in 1908 to 113,840 tons. The improvement of the channel is reported to enable the delivery of coal by water at rates 35 to 50 cents per ton less than by rail.

The head of navigation is at the hat factory, one-half mile above the railroad bridge at Haverhill, to which point the stream is navigable in fact, 17½ miles above its mouth in Newburyport Harbor.

June 30, 1909, the maximum draft that can be carried at mean low water over the shoalest part of the improved channel is 7 feet, except just below Rocks Bridge, where it is reduced by small bowlders to about 5 feet.

The removal of these bowlders is in progress.

The mean range of tides is, at the mouth of the river, 7.7 feet, and at Haverhill Bridge 4.6 feet, at low-water stage of the river.

The project of 1870–1874 is published in the Annual Report of the Chief of Engineers for 1869, page 421; as extended in 1874, in report for 1876, page 165; as extended in 1896, in report for 1896, page 616; and the existing project adopted in 1899, in report for 1897, page 865.

The report of a survey, with estimate of cost to deepen the channel to 9 feet at mean low water, is published in Annual Report for 1904, pages 872–878.

An examination for a channel 12 feet deep to Haverhill (unfavorably reported), and a survey and estimate for removing obstructions at the mouth of the river (favorably reported), made in 1906, are published in House Document No. 339, Fifty-ninth Congress, second session.

Reports of examination and survey, with map, for a channel 14 feet deep from the mouth of the river to Haverhill, by providing locks and dams, are printed in House Document No. 2, Sixty-first Congress, first session.

The project having been completed, it is proposed to apply the appropriation recommended to the maintenance of the improved channel.

July 1, 1908, balance unexpended	$3,142.58
Amount allotted from appropriation by river and harbor act approved March 3, 1909	10,000.00
	13,142.58
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,131.96
July 1, 1909, balance unexpended	12,010.62
July 1, 1909, outstanding liabilities	760.75
July 1, 1909, balance available	11,249.87
July 1, 1909, amount covered by uncompleted contracts	2,675.92
Amount that can be profitable expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

MYSTIC RIVER, MASSACHUSETTS.

Report on a recent survey is presented in House Document No. 1086, Sixtieth Congress, second session.

The report of the Board of Engineers, in which the Chief of Engineers concurs, is as follows:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., May 25, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

The existing project for the improvement of this locality provides for the dredging of a channel 300 feet wide and 25 feet deep at mean low water between Chelsea Bridge and a point 800 feet above the mouth of Island End River, the improvement of the river below the bridge, which was originally contemplated by this project, being now included under the project for improving Boston Harbor, as explained in the report on preliminary examination.

Based upon the information derived from the survey, the district officer submits an estimate of cost, amounting to $172,000, covering the dredging of the river to a depth of 30 feet between Chelsea Bridge and Island End River, as specified by the act, which, it will be noted, does not include the upper 800 feet of the projected 25-foot channel contemplated by the present project. Between the bridge and the mouth of Island End River, the 25-foot channel dredged under the present project follows the left bank of the river, but it appears that above the latter point commercial development is first to be anticipated along the right bank, and for this reason the district officer recommends that the dredging of the upper 800 feet of the 25-foot channel be abandoned and the proposed 30-foot channel given a suitable flare at its upper end, which will permit its extension along the right bank when found necessary in the future, and will also afford needed facilities for turning large vessels at the mouth of Island End River.

Deducting from the estimated cost of the 30-foot channel the amount remaining unappropriated for the completion of the existing project, it is found that the work now proposed will cost only $40,175.70 more than would be required to complete the improvement of the stream above Chelsea Bridge under the present plan for a 25-foot channel. The maintenance is estimated to cost $2,000 per annum.

Having in mind the amount and character of the commerce arriving and departing at the stretch of river under consideration, the Board believes that the proposed increase of depth to 30 feet is justified, and it also believes that the delimitation of the 30-foot channel, as proposed by the district officer and indicated on the accompanying tracing, will best meet the needs of the locality and permit, along advantageous lines, such further extension of the channel as may in future be found desirable. For these reasons it concurs with the division engineer in recommending that the present project for the improvement of this locality be modified to cover the work deemed advisable by the district officer.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

The commerce pertaining to this portion of Mystic River consists largely of coal, for the economical transportation of which carriers

of deep draft are essential. The statistics for 1905 indicate a waterborne commerce of 3,274,812 tons, and the within report states that the commerce for 1906 amounted to 2,401,060 tons.

TAUNTON RIVER, MASSACHUSETTS.

This river rises in Norkfolk County, Mass., and empties into Mount Hope Bay at Fall River.

In its original condition the channel was narrow and obstructed by bowlders and from Berkley Bridge to Taunton the depth was in places not more than 5 feet at mean high water. A vessel of 30 tons burden was as large as could go up to Taunton. From 1870 to 1879 $63,000 was appropriated and expended to secure 9 feet depth at high water. This work was completed in 1879.

The existing project, adopted June 14, 1880, provides for the widening and deepening of the river so as to secure a channel of at least 12 feet depth at high water, with 100 feet width from its mouth up to Berkley Bridge (above Dighton); thence 12 feet depth with 80 feet width (100 feet width at bends) up to Briggs shoal; thence 11 feet depth with 80 feet width up to the "shipyard;" thence with 11 feet depth with 60 feet width up to Weir Bridge, Taunton; all at a total cost estimated in 1893 at $125,000, all of which has been appropriated.

The amount expended on the existing project up to June 30, 1909, exclusive of outstanding liabilities, was $134,316.36, by which all projected work had been practically completed and the shoals offering the greatest obstruction to the navigation of the river had been redredged several times. About $28,316.36 of the above amount has been expended in the maintenance of the channel. Vessels of 11 feet draft can reach Taunton at high water, but at some points the 11-foot channel is very narrow. It is estimated that $5,000 every four years will be required to maintain the channel.

The head of navigation is about 1 mile above Weir Bridge, 14 miles above Fall River. No portion of the river above Weir Bridge has been improved.

The mean range of the tide is about 5¼ feet at Dighton and 3.4 feet at Taunton.

The expenditures during the fiscal year were for the removal of a shoal opposite the stove-lining works at the lower end of Weir village, and a few obstructing bowlders at points farther down the river.

It is proposed to apply the amount estimated as a profitable expenditure to dredging in such portions of the river as may shoal by freshets or otherwise.

The tonnage of 1908 was about 74,323 tons, mostly coal and other fuel and minerals, valued at $359,008.

Further work on this river will be for the maintenance of benefits secured by the improvement.

July 1, 1908, balance unexpended	$4,989.45
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	9,989.45
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	4,305.81
July 1, 1909, balance unexpended	5,683.64
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	5,000.00

WEYMOUTH BACK RIVER.

In its original condition Weymouth Back River had a practicable channel not less than 200 feet wide and not less than 12 feet deep at mean low water from its confluence with Weymouth Fore River, 8,000 feet to the wharf of the American Agricultural Chemical Company, except on its bar, 400 feet across, one-fourth of a mile above its mouth, where the depth was 11 feet, and except the 2,000 feet next below that wharf, where the depth gradually shoaled from 12 feet to 6 feet at mean low water.

The original project, adopted by a proviso in the act of August 18, 1894, which is also the existing project, is to dredge in Weymouth Back River a channel, 12 feet deep at mean low water, 200 feet wide through the bar, and to extend the channel, 12 feet deep at mean low water and 200 feet wide, 2,200 feet, to the wharf of the American Agricultural Chemical Company, at an estimated cost of $22,000.

The amount expended on this project is $22,000 (including $1,521 32 for maintenance), with which the channel has been dredged to the dimensions authorized by the project. After the completion of the improvement, by the application of the remaining funds in maintenance during the fiscal year 1908 the full depth of channel previously dredged was restored with the width of 175 feet through the bar near the mouth of the river and 180 feet thence to the head of the improvement. The present deficiency in width is due to deterioration of the portion of the channel dredged in 1897, and the amount estimated as a profitable expenditure for the fiscal year ending June 30, 1911, will be applied to restoring the full width of the improved channel.

The maximum draft that can be carried at mean low water over the shoalest part of the locality under improvement is 12 feet. The mean range of tides is 9.4 feet.

The head of navigation is about 4 miles above the bar at the mouth of the river, and about 3 miles above the wharf of the chemical company, which is the upper limit of the improvement.

The commerce benefited by the improvement comprised, in 1907, 169,756 tons, and, in 1908, 170,064 tons, of which about seven-eighths was raw and manufactured fertilizer products.

A report of the survey of Weymouth Back River is printed in the Annual Report of the Chief of Engineers for 1891, page 683.

Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement..... $5,000.00

HARBOR OF REFUGE AT BLOCK ISLAND, RHODE ISLAND.

This island is about 14 miles east of the eastern end of Long Island, and about 10 miles distant from the nearest point of the mainland.

The object of the improvement was to furnish a harbor of refuge for medium-draft vessels engaged in foreign and coastwise commerce.

Before the construction of the present harbor Block Island had no harbor at all.

The mean tidal range is about 3 feet.

Between 1870 and 1876, $285,000 was appropriated for a breakwater on the eastern side of the island for a harbor for medium-draft vessels, this work being completed in 1878. Between 1880 and 1882 $25,000 was appropriated for dredging an inner basin and the protection of the shore next to the breakwater, this work being completed

in 1884. In 1884 $15,000 was appropriated for additions to the breakwater, this money being so spent and the work completed in 1884–85.

The project of 1884, as modified in 1888, provided for the construction of a harbor of refuge consisting of an inclosed inner harbor 800 feet square, protected by an L-shaped breakwater, for small vessels, and an exterior harbor for larger ones, protected by the original breakwater, at a total cost estimated in 1888 at $75,000. This project was practically completed in 1893.

The total expenditure prior to commencing work on the existing project was $400,575.17.

The existing project of June 3, 1896, provides for raising the entire breakwater to proper height and stopping sand leaks between certain points and dredging the main inner harbor to a depth of 10 feet, at an estimated cost of $83,985.

At the adoption of the present project this harbor was neither large enough nor well enough protected for the proper harborage of the craft seeking refuge at this place during storms and bad weather.

The sum of $118,172.39 had been expended on the existing project up to June 30, 1909, of which $17,983.47 was for maintenance. By this expenditure the entrance to the inner harbor, which had shoaled up from the drift of sand, had been partially dredged to a depth of 12 feet and redredged to a depth of 10 feet several times. The north wall of the inner harbor had been strengthened and repaired and the existing project completed. The accumulation of sand along the inner side of the original breakwater, as noted for a number of years, continues, and $12,500 was allotted from the appropriation made by the river and harbor act of March 3, 1909, for maintenance.

No work of improvement or maintenance was carried on during the year beyond a survey of the harbor and receiving proposals for redredging portions of the harbor which had shoaled since the previous work. The improvement provides an anchorage of about 17 acres, with a least depth of 10 feet at mean low water, 10 acres of which is within the walls of the inclosed inner harbor. The commerce of this harbor amounts to 11,861 tons, chiefly fish and general merchandise, valued at $591,873.

Further work awaits action of Congress on the project submitted in compliance with the provisions of the river and harbor act of March 2, 1907.

July 1, 1908, balance unexpended		$719.42
Amount allotted from appropriation by river and harbor act approved March 3, 1909		12,500.00
		13,219.42
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$132.08	
For maintenance of improvement	143.73	
		575.81
July 1, 1909, balance unexpended		12,643.61
July 1, 1909, outstanding liabilities		50.06
July 1, 1909, balance available		12,593.55
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		12,500.00

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document 828, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., February 10, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

In the within report on a survey of the harbor of refuge at Block Island, Rhode Island, the district officer submits an estimate of cost, in the sum of $132,000, for dredging to a depth of 15 feet at mean low water the area indicated on the accompanying tracing, and for rebuilding the walls of the inner basin and the shore end of the main breakwater, the work of rehabilitating these harbor structures being considered essential to the efficiency of the improvement.

In its report of September 30, 1907, reviewing that of the district officer on a preliminary examination of this locality made "with a view to securing increased depth and an enlarged anchorage area," the Board gave a brief summary of the commercial and navigation conditions which appeared to warrant this further improvement of the harbor, provided it could be executed at reasonable cost. The commerce of the harbor is not large and would not, in itself, justify an additional expenditure of $132,000 for the work now proposed, but in its function as a harbor of refuge for the numerous fishing and other craft operating throughout a wide range of water remote from other suitable harbors the locality merits particular consideration.

The depth of 10 feet, which is provided for this harbor by the present project, is inadequate for many of the vessels having occasion to use it, and, inasmuch as nearly $500,000 has previously been expended by the United States at this locality, of which the larger part was for fixed structures, the Board is of the opinion that it is advisable to execute the work now proposed by the district officer in order to fully qualify the harbor for the purposes for which it was constructed. The Board therefore recommends approval of the project contained within.

GREAT SALT POND, BLOCK ISLAND, RHODE ISLAND.

The Great Salt Pond is located about the center of Block Island and contains an anchorage area of 150 acres for vessels drawing 18 feet and over. The work of converting the pond into a harbor of refuge by making a channel through the beach on the west, connecting it with deep water in the ocean, was started by the State of Rhode Island and the town of New Shoreham.

The channel, under the existing project of June 3, 1896, as modified in 1900, is to be 600 feet wide and have a central depth of 25 feet for a width of 150 feet, sloping gradually to 12 feet in a width of 504 feet, the channel seaward to be protected on the south by a jetty extending to 350 feet beyond the original 18-foot contour and on the north by a jetty about 1,200 feet long, and the sides of the channel where it passed through the original beach to be protected by stone revetments and sand fences, at a total estimated cost of $305,000.

At the time the work commenced under the General Government a channel of varying width and depth had been dredged with the money appropriated by the State and town, which would permit of 12-foot draft being carried in.

The south jetty had been built out 837 feet, and a north jetty 250 feet long had also been built, but at a distance of 720 feet from the south jetty instead of 600 feet, as called for in the adopted project.

The mean rise and fall of the tide is about 3 feet.

Up to June 30, 1909, $198,979.89 had been expended by the General Government on the existing project, of which $9,943.24 had been used for maintenance and repair. By this expenditure the south jetty had been extended 439 feet beyond the originally projected length, making a total of 1,691 feet from the initial point on shore.

Some damage done by a severe storm in the spring of 1900 had been repaired. The 25-foot deep channel 150 feet wide had been completed, and a cut 23 feet deep and 30 feet wide had been made on either side of it, that on the northerly side of the channel going but about halfway through. The 18-foot depth had been dredged to a width of 300 feet.

During the last fiscal year a survey of the entrance has been made. The dredge *Gedney*, transferred to this district in the latter part of June, was engaged two days in dredging sand that had accumulated in the channel.

There remains to complete the existing project the construction of jetties as planned and dredging to secure the widths and depths projected, and the appropriation asked for will be applied to this work.

The work required to complete the existing project is for the purpose of extending the benefits of the improvement.

The commerce of this harbor amounts to 10,458 tons, chiefly of fish and general merchandise, valued at $636,425. During the summer season a large number of passengers is carried to Block Island through this harbor.

Provision was made in the river and harbor act of March 3, 1909, for a preliminary examination and survey of the inner harbor of the Great Salt Pond, report of which will be submitted as soon as possible.

July 1, 1908, balance unexpended		$8,848.59
Amount allotted from appropriation by river and harbor act approved March 3, 1909		12,500.00
		21,348.59
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$7,688.48	
For maintenance of improvement	140.00	
		7,828.48
July 1, 1909, balance unexpended		13,520.11
July 1, 1909, outstanding liabilities		946.33
July 1, 1909, balance available		12,573.08
Amount (estimated) required for completion of existing project		105,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909		105,000.00

HARBOR OF REFUGE AT POINT JUDITH, RHODE ISLAND.

Point Judith is the southeastern extremity of the township of South Kingston, R. I., and marks the southwestern entrance to Narragansett Bay. A long ledge, known as "Squid Ledge," projects over a mile from the shore in a direction south by east about 1.5 miles west of the point. This location was dangerous for vessels to pass during a storm, especially for the light-built barges transporting coal from New York Bay points to Narragansett Bay.

The existing project of September 19, 1890, provides for the construction at this point of a natural harbor of refuge nearly a square mile in area, by means of two stone breakwaters. The main breakwater, built partly on Squid Ledge, is approximately V-shaped, facing outward in a direction about south by west, and lying at a considerable distance from the shore. Eastward of the main breakwater a detached breakwater, nearly parallel to the line of the eastern

arm of the main breakwater prolonged shoreward, was planned to shelter the eastern entrance, so as to give protection against easterly, southerly, and westerly storms, the mainland itself forming a protection on the north, all at a total cost estimated in 1889 at $1,250,000. This project was modified by the report of a Board of Engineers convened to consider and report upon the construction of this harbor, which was approved November 16, 1896, and provided for raising the crest of the eastern arm and extending the western arm to its originally projected length, at an estimated cost of $444,311, and deferring the construction of the easterly detached breakwater as a part of the main project until the completion of the main breakwater should demonstrate its necessity or otherwise. The river and harbor act of June 13, 1902, made a further modification by providing for the construction of the easterly detached breakwater and continuing it to the shore, at an estimated cost of $196,193 for the detached breakwater and $187,558.80 for the shore extension. A further modification was made by the act of March 2, 1907, authorizing an extension seaward of the easterly breakwater at an additional estimated cost of $186,248.20, making the total cost of this breakwater $570,000 and a total estimate for the project and its modifications of $2,264,311.

The river and harbor act of March 2, 1907, provided for the further extension of the easterly breakwater under the continuing-contract system, appropriating $100,000 therefor and authorizing the expenditure of an additional $170,000 (appropriated by the sundry civil act of May 27, 1908) for its completion. Under date of May 11, 1907, a continuing contract was entered into for this extension. Work under this contract was commenced June 15, 1907, and it was completed January 11, 1909, and leaves an easterly opening into the harbor 1,200 feet in width. About $8,443.35 was expended during the year in repairs to the main breakwater.

The sum of $1,793,823.78 had been expended on this work up to June 30, 1909, of which $14,860.67 was for maintenance. By this expenditure the main breakwater had been built to a total length of 6,970 feet with a height of 10 feet above mean low water, and the easterly breakwater had been completed for a distance of 2,240 feet out from the high-water line on shore to about 30 feet depth of water.

Before the construction of the breakwater the area inclosed within the lines upon which it has been built and the shore was about 640 acres, of which 390 acres has over 25 feet of water and 198 acres additional over 18 feet. The 18-foot area and the whole water-covered area has since been considerably reduced by shoaling in the western part.

Proceedings for the condemnation of land required for the shore end of the breakwater are in progress. The decree condemning the land to the uses of the United States was entered on May 26, 1906, and the commission to assess the land damages viewed the land May 23, 1907. A hearing was held before the commissioners at Narragansett Pier on August 14, 1907, and at Providence, R. I., May 27 and 28, 1909.

About 79 per cent of the approved project with its modifications have been completed. The result of the improvement has been to create a harbor of refuge fairly suitable for sailing vessels and steam-

ers, though the holding ground is poor, but not well suited for tows of barges, on account of the narrowness of the entrances, the direction of the entering courses with respect to that of the worst seas and the fact that the central part of the area is obstructed by a dangerous reef.

About 30 feet can be carried at mean low water into the eastern and from 18 to 19 feet into the western entrance. The mean range of tide is 3.1 feet.

Seven hundred and fifty-five vessels used the harbor during the fiscal year, of which 192 belonged to the contractor for construction and maintenance of the breakwaters. Of these 755, there were 301 schooners, 149 sloops, 64 steamers, 11 yawls, 117 tugs, and 113 barges; but 101 of the tugs and 91 of the barges belonged to the contractors.

The storms of the winter of 1908–9, accompanied by high tides, damaged the breakwaters to some extent, which will be repaired with funds in hand.

The river and harbor act of March 2, 1907, provided for an examination with a view to further improvement of the harbor. The report of this examination was printed as House Document No. 911, Sixtieth Congress, first session, in connection with which matter House Document No. 935, Sixtieth Congress, first session, contains certain papers relating to Point Judith Harbor of Refuge, bearing upon its importance and the necessity for a landing pier at that place No estimate is submitted for further work on the existing project for this locality pending action by Congress on the modified plan of improvement contained in the report of examination just mentioned.

July 1, 1908, balance unexpended		$193,049.99
Amount allotted from appropriation by river and harbor act approved March 3, 1909		10,000.00
Amount allotted from emergency appropriation by river and harbor act approved March 2, 1907		10,000.00
		213,049.99
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$158,386.81	
For maintenance of improvement	8,443.35	
		166,830.16
July 1, 1909, balance unexpended		46,219.83
July 1, 1909, outstanding liabilities		52.50
July 1, 1909, balance available		46,167.33
Amount (estimated) required for completion of existing project		444,311.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		20,000.00

The following report of the Board of Engineers on a recent examination of Point Judith Harbor of Refuge is concurred in by the Chief of Engineers and printed in House Document No. 911, Sixtieth Congress, first session:

THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., April 15, 1908.

GENERAL: 1. The act of March 2, 1907, in the item appropriating funds for improving Point Judith Harbor of Refuge, provided that—

"the Secretary of War may cause an examination to be made with a view to determining whether a breakwater on the westerly side of said harbor of refuge is necessary

to prevent sand movements, or for the protection of the sheltered area within the same, and also what further improvements, if any, should be made therein."

2. The report of the district officer on this examination has been under consideration by the Board at a number of its recent sessions. On March 9, 1908, Mr. Frank S. Gardner, corresponding secretary of the Navigation Conference, and secretary of the New York Board of Trade and Transportation, appeared before the Board in behalf of the interests represented by those organizations, and Mr. S. I. Kimball, General Superintendent of the Life-Saving Service, accompanied by his civil engineer, addressed the Board in reference to the life-saving station at this locality. On March 24 a committee of the Board visited Point Judith and made a personal inspection of the harbor and the works of improvement. The Board has also given consideration to various papers submitted by persons interested in the improvement of the harbor, and by a number of organizations, including the New York Board of Trade and Transportation, the Navigation Conference, the Business Men's Association of Providence, etc., embodying their views as to the further improvements needed.

3. The construction of a harbor of refuge at Point Judith was authorized by the act of September 19, 1890, which made an initial appropriation of $75,000 for commencing the improvement. Work at this harbor up to the present time has resulted in the construction of a main detached breakwater and in the partial construction of an easterly arm. This arm was originally designed to be detached from the shore, but recent modifications of the project have provided for its extension to the shore and also its further extension seaward. Contract has been made for the completion of the shore arm as authorized by the act of March 2, 1907, and it is expected that this work will be completed during September of the present year.

4. With reference to the questions specified for consideration by the act ordering the present investigation, the district officer believes that a breakwater on the westerly side of the harbor is necessary for both of the purposes stated, but he recommends that the further extension of the westerly arm toward the shore be abandoned and that an arm from the shore be substituted, leaving a gap of about 1,600 feet in the deepest water to afford entrance to the harbor. The only further improvement which he believes should be made at the present time is the dredging of shoal areas within the harbor and at the western entrance. The total cost of the new work recommended is estimated at $846,502.80. Eliminating certain work which will not be necessary if this plan is adopted, it is found that the completion of the harbor as proposed by the district officer will cost $452,191.80 more than its completion under the existing project.

5. An analysis of the papers before the Board indicates that, in addition to the work contemplated by the existing project, certain interests express a desire for the following improvements:

"(*a*) The building of a landing place.

"(*b*) Establishment of a suitably equipped life-saving station.

"(*c*) Proper lights and fog-signals.

"(*d*) Construction of westerly arm extending outward from the shore, as recommended by the district officer.

"(*e*) Removal of shoals and bowlders within the harbor, as recommended by the district officer.

"(*f*) Raising the easterly shore arm an additional height of 5 feet.

"(*g*) The extension of the seaward end of the arm in the shape of a hook or turn."

6. As originally adopted, the project for the improvement of this locality provided for the construction of a breakwater designed only to afford a harbor of refuge. The act of June 13, 1902, in appropriating funds for continuing improvement, gave the Secretary of War discretion to expend so much thereof as might be necessary "in constructing the easterly detached breakwater and continuing it to the shore with a view of providing a shelter for a landing place for the passengers, crews, and cargoes of vessels in distress and other vessels, and for the lifeboats of the Point Judith life-saving service." The acts of March 3, 1905, and June 30, 1906, likewise provided for the extension of the easterly or shore arm with a view to the purposes above specified.

7. In designing and constructing the easterly shore arm, the purpose specified in the law has been kept in view, and even in its incomplete condition the structure accomplishes this object to a great extent. When this arm is completed the protection will be greater still.

8. The Board has had referred to it a letter from the Secretary of the Treasury to the Secretary of War, of March 9, 1908, inclosing one from the General Superintendent of the Life-Saving Service and a report from the civil engineer of that service, in which it is stated that a pier and other structures and equipment suitable for the uses of a life-saving station within the harbor can be provided at an estimated cost of $63,000. The pier for the use of the Life-Saving Service would extend out a distance of 575 feet

to a depth of 12 feet. A wharf for vessels of greater depth would have to extend out to deep water.

9. The Life-Saving Service has indicated what conveniences for landing are needed for its purposes, and the advisability of providing these conveniences at government expense is not questioned by the board.

10. The board also has before it a letter from the Secretary of Commerce and Labor to the Secretary of War, of March 8, 1908, in which it is estimated that suitable lights and fog signals can be established at a cost of $12,000. Proper aids to navigation are of course indispensable to the efficiency of the harbor of refuge, but, like the proposed work for the Life-Saving Service mentioned above, fall within the jurisdiction of another department of the Government, and no further reference to these matters by this board appears to be necessary, except to state that if appropriations be made the work for the Life-Saving Service could conveniently be done by the Engineer Department in connection with its other construction work.

11. The construction of the westerly breakwater, as mentioned, has been carefully considered by the district officer, who, as above stated, believes that the extension of the westerly arm should be abandoned and that there should be substituted an arm from the shore, leaving a gap of about 1,600 feet between this and the main structure. This change in the project will serve to prevent the movement of sand along the shore, and will furnish additional protection to the sheltered area within the harbor. For these reasons the Board believes that this modification of the project is advisable.

12. The removal of shoal spots and bowlders in the harbor, as desired by interested parties, is recommended by the district officer, as is also the dredging of a 10-foot channel in lee of the easterly shore arm. This work will increase the available deep-draft anchorage area and the depth in the proposed westerly entrance, and afford access to the shore on the government reservation, and in the opinion of the board is advisable to promote the efficiency of the harbor.

13. The addition of 5 feet to the height of the easterly shore-arm breakwater, which is also desired by the interests concerned, is believed by the district officer to be unnecessary. After careful consideration of available information as to storm conditions at this harbor, and particularly having in mind the statement that during easterly and southeasterly storms the waves break completely over this breakwater, it appears to the Board that the proposed increase in height is desirable in order to afford more perfect protection to the area immediately behind the breakwater. There is no estimate of cost now available for raising this breakwater to an additional height of 5 feet, as above recommended, but such an estimate can be secured from the district officer at any time.

14. The existing project provides for an opening 1,200 feet wide between the main breakwater and the easterly shore arm. Some of the interests concerned have suggested the advisability of narrowing this entrance with a view to securing additional protection inside. To obtain the greatest efficiency a harbor of refuge should be easily accessible under all conditions of weather, and for this reason the entrances should be as wide as possible without unduly exposing the area inclosed. For these reasons the Board is of the opinion that the eastern entrance should not be less than provided for by the present project, namely, 1,200 feet. The seaward end of the shore arm breakwater being incomplete, the Board believes that the direction of the part still to be constructed can be advantageously changed by building from its present outer end on a line directly toward the completed end of the main breakwater. No new estimate on account of this modification would appear to be necessary.

15. With reference to the further extension of the outer end of the easterly shore arm by means of a right-angle hook, as suggested in the communication from the Life-Saving Service, the Board is of the opinion that such work is not necessary or desirable. From a study of a map and report submitted by the district officer, it appears that this arm, even in its present incomplete condition, affords reasonable protection along the shore for a distance of 1,500 feet from the end of the breakwater during the storms which cause the maximum disturbance. The completion of the breakwater along the lines now recommended will still further increase the protection. The extension proposed by the Life-Saving Service would be parallel to the direction of the waves during such storms, and would therefore have little beneficial effect.

16. In conclusion, the Board recommends that the project tor the construction of a harbor of refuge at Point Judith be modified to provide for a westerly breakwater extending from the shore to a point 1,600 feet from the end of the main breakwater, the deepening of the western entrance, the dredging of shoal areas within the harbor, and of a channel affording approach to the government reservation, as recommended by the district officer, at a total cost of $846,502.80, or $452,191.80 in excess of the cost of completing the existing project; and in addition to this work recommends increasing the height of the easterly shore arm 5 feet. It also recommends that the comple-

tion of the seaward end of the easterly breakwater, which is already provided for, should be on a line running toward the end of the main breakwater, as suggested above.

For the Board:

Very respectfully,

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

The following is extracted from House Document No. 935, Sixtieth Congress, first session.

NEW YORK, *May 4, 1908.*

Hon. W. H. TAFT,
Secretary of War, Washington, D. C.

DEAR SIR: In response to your suggestion that facts be furnished bearing upon the importance of the Point Judith (Rhode Island) national harbor of refuge, and showing the precedent for providing through the War Department for the construction of a landing pier therein which may be available for the "passengers, crews, and cargoes of vessels in distress, and other vessels, and for the lifeboats of the Point Judith life-saving service," we have the honor to submit the accompanying papers, which are—

First. A statement of the number of vessels which passed Point Judith in the daylight and an estimate of the number of vessels which passed Point Judith in the night from January 1, 1907, to January 1, 1908 (sheet 1).

Second. The number of vessels taking shelter in the Point Judith harbor of refuge from January 1, 1907, to January 1, 1908 (sheet 1).

Third. By way of comparison as to importance, the number of vessels taking shelter in the Delaware breakwater and harbor of refuge during years 1904 and 1905 (sheet 1).

Fourth. An article from the Marine Journal and an article from the New York Journal of Commerce comparing the number of vessels passing Point Judith, Rhode Island, and the number of vessels entering the port of New York (sheet 2).

Fifth. A brief history of the origin of the landing pier in the Delaware breakwater and harbor of refuge which was constructed by the War Department, thus establishing the precedent for building a similar landing pier by the War Department in the Point Judith harbor of refuge (sheet 3).

Sixth. Extracts from various newspapers giving brief accounts of numerous disasters in and in the immediate neighborhood of the harbor of refuge, Point Judith, Rhode Island (sheets 4 to 26, inclusive).

The manifest great importance of the commerce that passes Point Judith is the warrant for the work thus far done by the Government at Point Judith. The frequent disasters occurring in that vicinity call loudly for every possible facility to make the harbor a veritable harbor of refuge. The construction of the landing pier in the Delaware breakwater and harbor of refuge by the Government, through the War Department, furnishes the precedent for the proposed general landing pier in the Point Judith harbor of refuge, and we hope you will concur in this view of the matter and recommend in your report to Congress that such pier be authorized in the Point Judith harbor of refuge.

Very truly, yours,

J. B. COGHLAN,
U. S. Navy, Chairman Special Committee
on Point Judith Harbor of Refuge.

PROVIDENCE RIVER AND HARBOR, MAINTENANCE, ETC.

The object of this improvement is to furnish a wide and deep channel for foreign and coastwise commerce from the ocean to Providence and to provide a deep-water anchorage for that harbor.

Before the improvement of the river in 1853 the available low-water depth was limited to 4.5 feet. Between 1852 and 1873, $59,000 was expended in securing first 9 feet and then 12 feet depth of channel.

The approved project of 1878, as modified in 1882, provided for deepening the river and deepening and widening its anchorage basins so as to secure a channel of at least 25 feet depth at low water with 300 feet width from the deep water of Narragansett Bay up to Providence, R. I., and so as to secure anchorage basins of 20 feet depth with 600 feet width, 18 feet depth with 725 feet width, 12 feet depth

with 940 feet width, and 6 feet depth with 1,060 feet width from Fox Point to Fields Point, all at a total cost estimated in 1882 at $675,000. This project was completed in 1895.

Another project originating in the river and harbor act of June 3, 1896, provided for securing a ship canal 400 feet wide and of a depth of 25 feet at mean low water from Sassafras Point, in Providence Harbor, through Providence River and Narragansett Bay by the most direct route practicable to the ocean by way of the "Western Passage," so called, at an estimated cost of $732,820. This project was put under the continuing-contract system and the amount expended on the work up to the close of the fiscal year ending June 30, 1908, exclusive of outstanding liabilities, was $476,210.28, by which the channel 400 feet wide and 25 feet deep had been completed from Sassafras Point to the deep water of Narragansett Bay by the Western Passage.

Under date of June 11, 1904, the Chief of Engineers authorized the use of $2,000 of the balance remaining on hand of the appropriation for securing a channel through the Western Passage of Narragansett Bay for the removal of certain obstructing rocks in Dutch Island Harbor, Rhode Island.

The total amount expended on projects previous to the existing project was $1,174,700.87.

The existing project, adopted by the river and harbor act of June 13, 1902, provides for an enlarged anchorage area of 25 feet depth, extending the full width of the harbor from Fox Point on the north to Long Bed and Sassafras Point on the south, including the area known as Green Jacket shoal, at an estimated cost of $607,778. This project was enlarged by the river and harbor act of March 2, 1907, so as to include an area of uniform width and 25 feet deep to the eastward of the main ship channel, between Long Bed and Kettle Point, for which $90,750 was appropriated, making the total estimated cost $698,528. The river and harbor act of March 3, 1905, placed this work under the continuing-contract system.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1909, was $676,739.85, by which all approved projects have been completed.

The effect of the works of improvement under the existing project is to provide an anchorage area in Providence Harbor of about 288 acres with 25 feet depth, except that in some of the earlier portions of the work there has been some slight shoaling. The area improved includes all of Providence Harbor lying between Fields and Kettle points on the south and Fox and India points on the north, limited by the harbor lines on the east and west, except a triangular area containing about 27.5 acres in the southeast corner of the harbor, concerning which an estimate of the cost of removal was submitted February 4, 1908, and printed as House Document No. 919, Sixtieth Congress, first session, and a strip along the western side of the southern portion of the harbor containing 32.8 acres, the survey of which was authorized by the river and harbor act of March 3, 1909.

The only work contemplated is that of maintenance of the existing project, and it is proposed to apply to this purpose the existing balance and the allotment of $15,000 made from the appropriation of March 3, 1909.

It is proposed to apply the sum of $30,000, estimated for maintenance for the fiscal year 1911, to the maintenance of the anchorage area and of the channel leading from Providence Harbor to deep water in Narragansett Bay..

For reference to reports containing more extended information, see Annual Report of the Chief of Engineers for 1905, page 85.

Reference to reports of examination and survey made in pursuance of act of March 2, 1907, will be found on page 97 of the Annual Report of the Chief of Engineers for 1908.

The commerce of Providence Harbor in 1908 was about 3,379,574 tons, chiefly coal, general merchandise, and fish, valued at $93,309,495.

July 1, 1908, balance unexpended	$126,130.80
Amount allotted from appropriation by river and harbor act approved March 3, 1909	15,000.00
Received from sale of material	2.77
	141,133.57
June 30, 1909, amount expended during fiscal year for works of improvement	104,342.65
July 1, 1909, balance unexpended	36,790.92
July 1, 1909, outstanding liabilities	41.76
July 1, 1909, balance available	36,749.16
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	30,000.00

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 919, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., February 24, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

It is estimated by the district officer that the area between Long Bed and Kettle Point can be dredged to a depth of 25 feet at mean low water at a total cost of $184,800, with additional small sums for maintenance when required. As indicated on the accompanying tracing, the work covers a triangular area of about 20 acres between the harbor line on the east side of the harbor and the limit of excavation under the existing project.

In reviewing the report of the district officer on the related preliminary examination, the Board expressed the opinion that "the commerce of Providence River and Harbor, which is large and important, justifies the provision of such navigation facilities as are requisite to the proper handling of traffic." The necessity for increased anchorage area, which will be provided by the improvement now under consideration, is evident from the immediate occupation of the areas dredged under the existing project and from the steady growth of the commerce of the port. It is the opinion of the Board that the work now proposed is justified by these considerations, and it therefore recommends approval of the project outlined within.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

The commerce of Providence is large and growing, and the anchorage area is used by vessels awaiting dock room or to be towed away after unloading. The tonnage of the port amounted to 3,086,003 during the calendar year 1906.

PROVIDENCE RIVER AND HARBOR, RHODE ISLAND.

Report on a recent survey is printed in House Document No. 606, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, January 27, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated May 3, 1909, and January 13, 1910, with map, by Lieut. Col. J. C. Sanford, Corps of Engineers, on preliminary examination and survey, respectively, called for by the river and harbor act of March 3, 1909, of Providence River and Harbor, Rhode Island, with a view to widening and straightening the channel between Kettle Point and Gaspee Point, and to extending the 25-foot-deep anchorage area westward of the western harbor line from a point just above Harbor Junction pier to Fields Point and cutting off Fields Point back to the harbor line.

This locality has heretofore been improved by the United States under a project which provided for securing an anchorage area with a depth of 25 feet, the project having been completed and present operations being confined to work of maintenance.

Colonel Sanford submits a project for further improvement, as contemplated by the above-stated law, by dredging to a depth of 25 feet at mean low water from the existing channel westward to the United States harbor line above Fields Point, the removal to this depth of that part of Fields Point projecting beyond the harbor line and continuing the improvement south of Fields Point between the existing channel and the United States harbor line prolonged for a distance of about 2,300 feet; also the continuation of the proposed depth of 25 feet from this point downstream to Gaspee Point by widening the present 400-foot channel to 600 feet in the straight reaches, with additional liberal widening at the turns. The estimated cost of this work is $264,423 for the harbor proper and $194,577 for the approach channel, a total of $459,000, which includes the removal of the foundations of Sassafras Point lighthouse, the superstructure of which the district officer states will be removed by the Light-House Establishment. The estimated cost of the maintenance of this improvement is $17,000 annually. The district officer recommends this improvement, contingent upon certain cooperation on the part of the city of Providence, and the division engineer concurs in his views.

These reports have been considered by the Board of Engineers for Rivers and Harbors, as required by law, and in its report dated January 24, 1910, herewith, the opinion is expressed that the magnitude and value of the commerce of the locality is sufficient to justify the cost of improvement now proposed for its benefit. The Board therefore recommends adoption of the project as outlined by the district officer and stated above.

Attention is invited to the remarks by the Board in paragraph 4 of its report relative to the recommendation of the district officer regarding additional public wharf facilities, which he deems necessary for the full use of the proposed improvement.

I concur in the recommendation of the Board.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

PAWCATUCK RIVER, RHODE ISLAND AND CONNECTICUT.

The navigable part of the Pawcatuck River extends 5 miles from Westerly, R. I., to its outlet, in Little Narragansett Bay, through the northern part of which a navigable channel extends 2½ miles to Stonington Harbor, Connecticut, through which Long Island Sound is reached.

Before improvement the channel of the river was crooked and obstructed by numerous shoals, on some of which there was 1 to 1½ feet of water, and the greatest depth that could be carried through the bay channel was 4½ feet.

The original projects, that of 1871 for the river channel and that of 1879 for the channel across the bay, provided for depths of 5½ and

7 feet and widths of 75 and 200 feet, respectively. The expenditure on the original projects was $97,500.01.

The present project, adopted in 1896, provides for a channel 10 feet deep from Stonington, Conn., to Westerly, R. I., with a width of 200 feet from Stonington to Avondale, R. I., a distance of about 4 miles; a width of 100 feet from Avondale to the lower wharves at Westerly, a distance of about 3 miles; and a width of 40 feet between the upper and lower wharves of Westerly, a distance of about one-half mile, at a total estimated cost of $200,361.60. The river and harbor act of March 3, 1905, authorized the use of $1,000 of the appropriation for the improvement of the Pawcatuck River in the removal of obstructions at Watch Hill, at the southeastern part of the Little Narragansett Bay. The greater portion of the obstructions was removed in January and February, 1906, at a cost of $865.82.

On this project $72,094.96 had been expended to June 30, 1909, therewith completing the section 40 feet wide along the wharves of Westerly, extending the 100-foot channel downstream 1,800 feet, making a channel through Little Narragansett Bay 100 feet wide and 10 feet deep and extending the 100-foot channel upstream to within 2,000 feet of the channel extended downstream from Westerly. Of this amount $15,080.41 was applied to maintenance. The project is about 25 per cent completed.

The maximum draft which could be carried June 30, 1909, was 10 feet in the bay channel, 7 feet in the river, and 6 feet near Watch Hill. The mean rise of tide is 2.6 feet at the mouth of the river and 2.3 feet at Westerly.

The effect of the improvement is to permit coal, lumber, and building material to be delivered in vessels at Westerly, and to ship therefrom granite in vessels instead of by rail, thus giving water competition for these materials, with a resulting benefit in the reduction of freight rates.

The available balance and the appropriation asked for will be applied toward maintenance and the completion of the project.

The reported tonnage for 1908 was 59,037, valued at $303,775.53.

July 1, 1908, balance unexpended	$25,459.74
June 30, 1909, amount expended during fiscal year, for works of improvement	19,554.71
July 1, 1909, balance unexpended	5,905.03
July 1, 1909, outstanding liabilities	5,772.25
July 1, 1909, balance available	132.78
July 1, 1909, amount covered by uncompleted contracts	100.00
Amount (estimated) required for completion of existing project	138,342.01
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	15,000.00

BRANFORD HARBOR, CONNECTICUT.

Branford Harbor consists of three distinct parts: The outer harbor, approximately 1 mile wide and three-fourths of a mile deep; the inner harbor, about half a mile in diameter, separated from the outer harbor by a series of rocks, the principal ones of which are known as "The Mermaids;" and the river, which empties into the inner harbor from the northeast. The natural low-water depths when improvement

began were: At the outside of the outer harbor, 15 to 16 feet, gradually shoaling to 8 feet near "The Mermaids;" through the inner harbor from "The Mermaids" to the mouth of the river, 7 to 8 feet; up the river for a distance of 1 mile, nearly to the lower docks, 12 feet or more. From the lower to the upper docks the channel gradually shoaled and narrowed so that the controlling depth was less than 6 feet and the width 25 to 50 feet. At the upper dock the stream is crossed by an earthen causeway, in which there is a small drawbridge which is rarely opened, although the stream is navigable for small craft to a fixed bridge about one-half mile above. Since the adoption of the present project a very general and uniform shoaling of 1 to 2 feet has taken place in the inner harbor, so that the controlling depth between "The Mermaids" and the mouth of the river, the shoalest place in the channel, was only about 6 feet.

The original and present project, adopted by the act of June 13, 1902, and modified by the act of March 2, 1907, provides for an 8½-foot channel 100 feet wide in the upper part of the river between the lower and upper docks and through the shoals at the mouth of the river, at an estimated first cost of $13,000.

This project was completed July 30, 1907, at which time channels of full project dimensions had been dredged from the 8½-foot curve in the lower harbor through the inner harbor to the mouth of the river, and in the upper portion of the river from below the lower docks upstream to the upper docks.

This work greatly facilitates navigation, and the effect of the improvement has been to reduce freight rates.

The maximum draft that could be carried June 30, 1909, from the entrance of the harbor to the head of the proposed channel was about 7 feet at mean low water in the lower harbor and 8½ feet in the river. The mean rise of tide is about 6.5 feet.

The amount expended on this project to June 30, 1909, was $11,221.63, of which $1,684.18 was for maintenance.

The commerce of this harbor is mainly coal, molding sand and clay, iron, and lumber. The tonnage reported for 1908 amounted to 20,669 net tons, valued at $100,362.80.

The available balance and the appropriation asked for will be applied to maintenance of the improvement.

July 1, 1908, balance unexpended	$1,851.69
June 30, 1909, amount expended during fiscal year for maintenance of improvement	73.32
July 1, 1909, balance unexpended	1,778.37
July 1, 1909, outstanding liabilities	20.67
July 1, 1909, balance available	1,757.70
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	2,000.00

BRIDGEPORT HARBOR, CONNECTICUT.

This consists of a shallow bay, about 1 mile wide at the mouth and 1½ miles long, into the extreme northwest corner of which empties the Poquonock River, a small tidal stream navigable for about 1 mile, and into the northeast corner another small stream about three-fourths of a mile long, known as Johnsons River. Midway between

these two streams is Yellow Mill pond, a tidal basin about 1 mile in length. Black Rock Harbor, now considered part of Bridgeport Harbor, lies about 2¼ miles to the westward. Both harbors are inner portions of a large bay of Long Island Sound lying between the eastern part of Stratford Point and Fairfield reef. Black Rock Harbor is about one-half mile wide at the mouth and 1 mile long, with two branches at its head, the east one a mile long, known as Cedar Creek, and the west one about three-fourths of a mile long, known as Burr Creek.

The original low-water depths were as follows: On the bar at the mouth of Bridgeport Harbor, about 5 feet; in the Poquonock River, from 2 to 5 feet; in Johnsons River, nearly bare in upper half; Yellow Mill pond, generally bare; in Cedar Creek, 2 to 4 feet; and in Burr Creek, nearly bare.

Congress appropriated $10,000 in 1836 and an equal amount in 1852 for improving the main Bridgeport Harbor. These sums were expended in dredging near the mouth of the harbor, making channels 60 to 100 feet wide and 8 feet deep or more at low tide. The depth did not prove permanent. In 1871 and at various times thereafter the original project was enlarged to afford a 15-foot main-harbor channel, a 12-foot channel 200 feet wide in Yellow Mill pond to Stratford avenue, a 9-foot Poquonock River channel, a 12-foot anchorage, and to protect the harbor entrance by two breakwaters, all estimated to cost $285,000. This project was completed in 1898, except as to capacity of the 15-foot channel.

The amount expended on the projects above named was $317,848.50.

At Black Rock Harbor, between 1836 and 1838, $21,550 was expended in building a sea wall across a breach in the southern part of Fayerweather Island. In 1884 a project was adopted for protecting the upper part of Black Rock Harbor by a breakwater about one-half mile long between Fayerweather Island and the mainland and for making a 6-foot channel 80 feet wide in Cedar Creek. The channel had been made, the breakwater built to full length, but with reduced cross section, and the project was considered as completed July 1, 1894. Subsequently repairs were made on the old sea wall on Fayerweather Island. The amount expended for Black Rock Harbor as a separate improvement was $72,900.

For details of original projects and their modifications, see Annual Reports of the Chief of Engineers, 1902, pages 133 and 134, and 1903, pages 116 and 117.

In the act of March 3, 1899, Congress adopted a project for Bridgeport Harbor which provided, at an estimated cost of not exceeding $300,000, for—

First. The main channel, 18 feet deep, 300 feet wide from the outer bar to the inner beacon, thence 200 feet wide to the lower or Stratford Avenue Bridge across the Poquonock River.

Second. Three anchorage basins: One 18 feet deep, 500 feet wide, and 2,000 feet long adjoining the main channel on the west above the inner beacon; one 12 feet deep, 500 feet wide, and 900 feet long adjoining the main channel on the west between the 18-foot anchorage and Naugatuck wharf; and one 12 feet deep at east side of channel between the steel works point and the lower bridge.

Third. Poquonock River channel, from the lower bridge to the head of navigation, about 1 mile, 12 feet deep and 100 feet wide.

Fourth. Yellow Mill channel, from the main channel to the head of Yellow Mill pond, about 1 mile, 12 feet deep and 100 feet wide.

Fifth. Johnsons River channel, from the main channel to the head of navigation, about 1¼ miles, 9 feet deep and 100 feet wide.

Sixth. Black Rock channel, from the head of Black Rock Harbor to the junction of Cedar and Burr creeks, thence up each of these creeks to the head of navigation, with lengths, respectively, of 1½ miles and one-half mile, 9 feet deep and 100 feet wide.

Seventh. The repair and maintenance of the outer and inner breakwaters of the main channel, and the one connecting Fayerweather Island with the mainland as now built, and the construction and maintenance of shore protection on Fayerweather Island to check the shifting of the beach.

An appropriation of $50,000 was made in the act cited and a continuing contract authorized, under which work was begun July 9, 1900, and carried on, with many interruptions and delays, until January 1, 1906, at which time the contract was 61 per cent completed. On account of the unsatisfactory progress this contract was annulled May 10, 1906, and the work relet. Work under the new contract was commenced July 25, 1906, and completed May 17, 1907, completing the project as authorized in 1899, except a section of Burr Creek, the inner end of Yellow Mill channel, and the inner end of Johnsons River, where, on account of ledge rock, the full project dimensions of the channels were not obtained.

The amount expended on this project to June 30, 1909, was $233,912.50, of which $33,026.91 was applied to maintenance, making the total expended on all projects prior to that now existing $624,661.

The act of March 2, 1907, authorized the extension of the project to include an anchorage basin 22 feet deep, 1,280,000 square feet in area opposite the inner breakwater, deepening the main entrance channel to 22 feet as far as the inner end of the 22-foot anchorage basin, an additional 12-foot anchorage basin 608,600 square feet in area northwest of the 22-foot basin, and two breakwaters for the protection of the deep anchorage basin, at an estimated cost of $463,000. The act appropriated $113,000 and authorized continuing contracts in the additional sum of $350,000 for completing the work authorized. Of this amount $210,000 is yet to be appropriated.

Reports of examination and survey containing the enlarged project are printed in House Documents Nos. 275 and 521, Fifty-ninth Congress, second session.

Contracts for the completion of the work authorized by the act of March 2, 1907, have been made. The breakwaters and the 12-foot anchorage basin have been completed and the deepening of the main channel commenced.

The amount expended on the project of 1907 to June 30, 1909, was $131,067.78, of which $2,943.64 was applied to maintenance.

The maximum draft that could be carried June 30, 1908, through the improved channels at mean low tide is about 18 feet through the main channel from the outer end to the lower bridge; in the Poquonock River, about 11 feet; in the Yellow Mill channel, 12 feet; in Johnsons River, 9 feet; at Black Rock, 9 feet to the head of navigation in both branches of Cedar Creek; in Burr Creek, about 7 feet to its head. The mean rise of tide is 6.5 feet.

The balance on hand and additional appropriations will be applied to completing the project and to maintenance.

The work done has greatly facilitated the navigation of the harbor and made the present commerce possible and materially reduced freight rates.

The commerce of this harbor is chiefly in coal, lumber, iron, building material, petroleum products, oysters, and general merchandise. Tonnage reported for calendar year 1908 was 890,895 tons, valued at $37,572,196.20.

July 1, 1908, balance unexpended		$107,108.13
Amount allotted from appropriation by river and harbor act approved March 3, 1909		10,000.00
Amount appropriated by sundry civil act approved March 4, 1909		100,000.00
		217,108.13
June 30, 1909, amount expended during fiscal year:		
Deposited with Treasurer of United States	$218.04	
For works of improvement	73,493.27	
For maintenance of improvement	2,943.64	
		76,654.95
July 1, 1909, balance unexpended		140,453.18
July 1, 1909, outstanding liabilities		11,503.01
July 1, 1909, balance available		128,950.17
July 1, 1909, amount covered by uncompleted contracts		107,709.62
Amount (estimated) required for completion of existing project		210,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		20,000.00

DUCK ISLAND HARBOR, CONNECTICUT.

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 398, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., November 4, 1907.

Respectfully returned to the Chief of Engineers, U. S. Army.

In the within report on a survey of Duck Island harbor of refuge, in connection with which a breakwater at Kelseys Point is considered, the district officer proposes a modification of that part of the existing project which has not been completed. In lieu of the two projected breakwaters between Duck Island and Menunketesuck Point, he proposes one breakwater of 1,100 feet in length, to be located on a reef making northward from Duck Island. It is believed this will give better protection from easterly and southeasterly winds than the breakwaters provided for in the existing project, and will perhaps lessen the tendency to fill in the harbor and make it easier of entrance.

He proposes to provide protection from westerly and southwesterly winds and storms by the construction of a breakwater 3,750 feet in length, near Kelseys Point on a reef about 8,000 feet to the westward of the light on the end of the existing Duck Island breakwater, and to bring the existing breakwater to full cross-section dimensions, but to omit the construction of the 303 feet yet required to complete its full project length.

He estimates the cost of all the work proposed, including $34,000 for administration, inspection, and contingencies, at $350,000 in round numbers, which is practically the same amount estimated to complete the existing project. It is believed the modifications proposed will provide a more commodious and safer harbor of refuge, more accessible and better adapted for the use of the vessels which seek shelter here.

The Board believes the locality worthy of further improvement by the General Government to the extent proposed, and it concurs with the district officer and the division engineer in recommending the modification of the existing project as outlined within.

For the Board:

R. L. HOXIE,
Colonel, Corps of Engineers,
Senior Member Present

The commerce which is interested in the improvement of this harbor is mainly that part of that passing through Long Island Sound that consists of the smaller sailing vessels and tows, but which form a very considerable part of the whole commerce of the Sound. No records of the number of vessels frequenting this harbor have been kept for several years until very recently, but since the 1st of February, 1907, the keeper of the light at Duck Island has been furnishing a daily report of the number of vessels using this harbor, and his reports show that from February 1 to April 28, 1907, 186 vessels entered the harbor. The greater portion of these vessels were schooners, but many of them were tugs with tows of barges. Few of them stayed more than a few hours, the harbor having been sought purely as a temporary refuge. Had there been a better harbor, more vessels would doubtless have used it.

HARBORS AT FIVEMILE RIVER, STAMFORD, SOUTHPORT, GREENWICH, AND WESTPORT, AND SAUGATUCK RIVER, CONNECTICUT.

(*a*) *Fivemile River Harbor.*—This is a tidal inlet about 1 mile long and from 100 to 1,000 feet wide. The natural low-water depth at the mouth was about 3 feet, shoaling to zero about halfway up the harbor and to about plus 2.5 feet at extreme head. The original and present project of improvement, adopted under authority of the act of August 11, 1888, provides for a dredged channel 8 feet deep and 100 feet wide, extending up the harbor about 6,000 feet from its mouth. The estimated cost from the beginning, as revised in 1894, was $45,000.

For further details regarding this harbor, see page 192, Annual Report of the Chief of Engineers, 1901.

Up to June 30, 1909, $39,790.44 had been expended on this project, of which $4,300 had been for maintenance. At that date a channel of project dimensions had been dredged about 5,400 feet up the harbor and thence about 200 feet farther with project depth and widths of 25 to 75 feet. No dredging has been done above this point. About 82 per cent of the project is completed.

The maximum draft that could be carried to the upper end of the improved channel is 7 feet, and no navigation is possible beyond this point except at high tide, when a draft of from 4 to 4½ feet can be carried about 1,400 feet farther to the head of navigation. The mean rise of tide is 7.2 feet.

The future appropriations will be applied toward maintenance and completion of the project by widening the channel to project dimensions and extending it upstream as funds permit.

The commerce of this harbor is mainly confined to the oyster industry, which could not be carried on to its present extent without the improved channel. Traffic reported for calendar year 1908 amounted to 21,986 tons, valued at $353,009.50.

(*b*) *Stamford Harbor.*—This consists of a bay on the north shore of Long Island Sound and of two tidal inlets known as the east and west branches, extending to the head of navigation at the city of Stamford. The original depth in the west branch was from 1 foot to 3 feet, gradually increasing in the bay to a depth of 12 feet. The east branch was originally a small marshy creek, deepened by private dredging to a depth of about 8 feet and which had shoaled so that

when work was begun by the Government in 1892 the available depth was only about 6½ feet.

The original project, adopted under authority of the river and harbor act of 1886, was for a 5-foot channel 80 feet wide to the head of the west branch. This was considered completed in 1892 after an expenditure of $20,000, the channel being 5 feet deep and 100 to 140 feet wide at the bends, but only from 50 to 70 feet wide for the last thousand feet at the upper end.

The present project, adopted under authority of the act of July 13, 1892, provides for a channel in the west branch 7 feet deep, 150 feet wide, and about 1⅛ miles long, with a basin of same depth between harbor lines at the head of the harbor, and in the east branch, as approved October 5, 1892, a channel 9 feet deep and 100 feet wide for a length of about 8,535 feet and 50 feet wide for about 1,200 feet farther to the head of the harbor. The estimated cost was $123,500. A modification to give increased width at upper end of east branch was approved February 12, 1901.

Up to June 30, 1909, $128,260.53 had been expended on this project, of which $32,511 had been for maintenance. At that date the channel in the east branch had been completed to full project dimensions; the channel in the west branch had been dredged to project dimensions from its outer end to the south end of the basin; a portion of the south end of the basin completed and a channel with a general width of 125 feet dredged along both sides and across the upper end of the basin. The available depth which could be carried June 30, 1909, to the extreme head of the west branch was 7 feet, and 9 feet through the east branch channel to its head. The mean rise of tide is 7.4 feet.

The appropriation asked for will be applied toward maintenance and completion of the project.

The commerce of this harbor consists mainly of coal, lumber, stone, sand, clay, ores, and steamboat freight. The reported tonnage for calendar year 1908 amounted to 343,810 tons, valued at $10,439,840.34. The improvements made have rendered it possible for the steamers to run on schedule time and to enter the harbor at any stage of the tide, which they were unable to do previously, and have materially reduced freight rates.

(*c*) *Southport Harbor.*—This is a tidal part of Mill River at town of Southport, about 1 mile long and averaging less than 100 yards wide. The original depth was probably less than 2 feet at the entrance to the harbor, shoaling to about plus 1 foot at the upper end. Work was begun in this harbor by the Government in 1829 and prosecuted with various intermissions until 1878. During this time a dike inside and breakwater or jetty outside were built, and a channel 60 feet wide and 4 feet deep dredged across the outer bar. In 1878 a project was adopted for dredging a channel 100 feet wide and 4 feet deep across the bar and upstream 1,200 feet from the outer end of the jetty, and thence in a bifurcated channel to the nearest docks. In 1882 this project was reported as substantially completed, $31,587.23 having been spent since the beginning of work in 1829.

The present project, adopted by act of June 13, 1902, is to dredge a channel 6 feet deep through the outer bar to the upper docks 100 feet wide to the turn above White Rock, and thence in two branches, each 60 feet wide; to repair the breakwater and to remove two points of ledge from the channel to a depth of 7 feet. The original esti-

mated first cost of this improvement was $13,200, and for yearly maintenance $300, to be expended biennially, but on account of the development of two additional outcroppings of ledge during the dredging it became evident that this estimate would be greatly exceeded before the work could be completed, and in 1906 the estimated cost was increased to $15,111 for this work.

For further details regarding this harbor and its former projects, see Annual Report of the Chief of Engineers, 1897, page 986.

Up to June 30, 1909, $20,348.51 had been expended on this project, of which $1,677.53 had been for maintenance. At that date a channel of project depth and 75 to 100 feet width had been dredged to the turn above White Rock, and thence with full depth and widths of 40 to 60 feet up the east branch and along the dock front for about 200 feet; two points of ledge rock had been removed and the breakwater repaired. About 65 per cent of the project is completed.

The maximum draft that can be carried through the improved portion of the channel is 6 feet. Above this point, where no dredging has been done, a draft of 3 to 4½ feet can be carried to the upper docks at low tide. Above the upper end of the projected channels the harbor is navigable only at high tide and for a distance of about half a mile. The mean rise of tide is 6.6 feet.

The improved channel permits vessels of not exceeding 6 feet draft to enter the harbor without being compelled to wait outside the bar in an exposed situation for the tide to rise.

The appropriation asked for will be applied toward maintenance and completing the project.

The commerce of this harbor consists mainly of farm produce, general merchandise, oysters, and coal. The reported tonnage for calendar year 1908 amounted to 6,821, valued at $66,060.

The effect of the improvement on freight rates, if any, is not known.

(*d*) *Greenwich Harbor.*—This is a shallow bay about 2 miles east from the New York state line, extending about a mile northward from Long Island Sound. The original low-water depth was about 6 feet to the lower docks. Above this point it shoaled rapidly to 3 feet 1,000 feet above and to about plus 2 at the head of the harbor. The original and present project, adopted in the act of June 3, 1896, is to dredge a channel 90 feet wide from the mouth of the harbor to the causeway at its head, a distance of about a mile, to be 9 feet deep to the steamboat dock and 6 feet deep above, the upper end to be enlarged to form a turning basin. The estimated first cost was $20,000. Page 860, Annual Report of the Chief of Engineers, 1895, gives report of examination upon which the project is based. Up to June 30, 1909, $21,090.60 had been expended on this project, of which $4,073.41 had been for maintenance.

This project was completed September 23, 1905. The work done has enabled vessels to enter the harbor with 9 feet draft at low tide, thus permitting the regular steamer to make trips without waiting for tide. Above the steamboat dock a draft of 6 feet can be carried at low tide to the head of navigation. The mean rise of tide is 7.5 feet.

Map of survey made in June, 1908, with reference to need of maintenance and the location and identification of harbor lines was completed during the fiscal year.

The appropriation asked for will be applied to maintenance of the improvement.

The commerce of this harbor consists mainly of coal, lumber, building material, and general merchandise. The reported tonnage for calendar year 1908 amounted to 76,160, valued at $9,778,000.

The effect of the improvement on freight rates, if any, is not known.

(*e*) *Westport Harbor and Saugatuck River, Connecticut.*—For description of these localities and statement of work under original project of 1826, and its modifications to about 1871, see Annual Report of the Chief of Engineers for 1901, page 189. The total amount expended for the same is $19,444.

The present project, adopted in 1892, originally provided for a channel 4 feet deep and 60 feet wide up to Westport, at an estimated cost of $10,000.

As a result of a survey authorized by the act of August 18, 1894, the project was modified in 1896 to provide for repairing the Cedar Point breakwater, removing a ledge opposite Stony Point, or dredging around it, and removing bowlders from the channel, at an estimated cost of $8,000, and the total estimated cost was in consequence increased to $18,000.

A sketch of this river and harbor is printed in the Annual Report of the Chief of Engineers for 1894, page 670, and report of the survey authorized in 1894 is printed in the Annual Report of the Chief of Engineers for 1896 and, with map, in House Document No. 67, Fifty-fourth Congress, first session.

The total amount expended on the present project up to the close of the fiscal year ending June 30, 1909, was $15,270.99, of which $109.44 was for maintenance. The 4-foot channel had been completed to Westport, head of navigation, with width generally of 60 feet, the ledge opposite Stony Point removed, and the Cedar Point breakwater repaired and extended. About 70 per cent of the project is completed. The mean rise of tide is about 7 feet.

Completion of the project requires further removal of bowlders and dredging to full project dimensions at the channel opposite Westport. Improvements made have rendered navigation of the river practicable at less than half-tide stages by vessels plying there.

Future appropriations will be applied to maintenance and the completion of the project.

The commerce comprises coal, lumber, farm produce, and steamboat freight. The reported tonnage for calendar year 1908 was 11,504, valued at $43,655.

The effect of the improvement on freight rates, if any, is not known.

CONSOLIDATED.

July 1, 1908, balance unexpended		$18,277.20
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$17,445.23	
For maintenance of improvement	826.04	
		18,271.27
July 1, 1909, balance unexpended		5.93
Amount (estimated) required for completion of existing project		54,311.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		48,411.00

MILFORD HARBOR, CONNECTICUT.

This harbor is on the north shore of Long Island Sound, and consists of a broad, open bay, from the head of which a small tidal stream extends nearly a mile inland to the head of navigation. The original depth on the bar in the bay at the mouth of the river was less than 2 feet. In parts of the river the channel ran nearly bare. The mean rise of tide is about 6.2 feet.

The original project, adopted under the act of June 23, 1874, provided for a riprap breakwater 890 feet long from Welchs Point, on the east side of the mouth of the harbor, protection of the bluffs on the east shore from erosion by means of small stone jetties, a jetty on the east side to maintain the river-bar channel, and dredging a channel 4 feet deep and 100 feet wide across the bar, the whole estimated to cost $85,000. This project was modified in 1878 and 1879 to provide for extending the 4-foot channel 60 feet wide upstream to the town dock and for a training dike off Burns Point, on the west side of the river channel, nearly at right angles to the east-side jetty. The project thus modified was completed in 1880, except that the outer breakwater was not built, being deemed unnecessary in view of the provision of a harbor of refuge at New Haven. Under the act of June 14, 1880, a project was adopted for the extension of the 4-foot channel, 40 feet wide, upstream to the Straw Works wharf, and under the act of August 2, 1882, a revised project was adopted which provided for a channel 8 feet deep and 100 feet wide across the bar and upstream to Merwin's dock, at estimated cost of $11,000.

In 1891 these projects were reported as completed and no further work necessary, except maintenance of jetties and dredged channels. It was stated in July, 1895, that as a result of private dredging there was a clear channel across the bar 12 feet deep and nowhere less than 80 feet wide. On the previous projects $45,500 and for surveys $1,600 were expended.

For further details regarding former projects see Annual Report of the Chief of Engineers for 1893, page 929, and for report on which present project is based see Annual Report of the Chief of Engineers for 1900, page 1357 et seq. For map see House Document No. 280, Fifty-sixth Congress, first session.

The existing project, authorized by act of June 13, 1902, for completion at a cost of $15,000, consists in dredging and maintaining a channel across the bar and through the lower harbor, 100 feet wide and 10 feet deep, to Merwin's wharf, with an anchorage basin of same depth of about 5 acres area on the east side of the channel between the long dike and the harbor line, and a channel through the upper harbor from Merwin's wharf to the Straw Works wharf 90 feet wide and 6 feet deep. The estimated cost for maintenance was $1,000 biennially. The first cost of the improvement was subsequently ascertained to be $25,000. The amount expended on this project to June 30, 1909, is $23,673.46, of which $23.84 was for maintenance.

The 6-foot channel has been extended upstream to a point about 500 feet above the town dock, a portion of the anchorage basin, about 2⅓ acres in area, adjacent to the 10-foot channel, dredged, and a basin, 1.6 acres in area, dredged on the opposite side of the channel opposite Merwin's wharf. Owing to ledge rock it was impracticable to complete this project within the estimate. The work done facilitates

navigation in the lower part of the harbor, and the extension of the 6-foot channel to the town dock renders it practicable to land cargoes of coal at this dock, which it was formerly extremely difficult to do. The development of the anchorage basins greatly relieves congestion in the lower part of the harbor, due to the anchoring of small pleasure craft and oyster schooners in that portion of the harbor.

The available balance and the appropriation asked for will be applied to maintenance of the improvement.

On June 30, 1909, a low-water draft of 9 feet could be carried over the bar and up as far as Merwin's wharf, thence 6 feet draft to a point about 500 feet above the town dock, and thence draft of about 2½ feet can be carried to the Straw Works dock. No navigation is practicable above this dock.

The commerce of this harbor consists almost entirely of oysters, shells, coal, and fertilizer, the former predominating. The reported tonnage for the calendar year 1908 amounted to 28,587 tons, valued at $411,533.22.

July 1, 1908, balance unexpended	$1,329.28
June 30, 1909, amount expended during fiscal year for maintenance of improvement	2.74
July 1, 1909, balance unexpended	1,326.54
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	2,000.00

BREAKWATERS AT NEW HAVEN, CONNECTICUT.

The original and existing project for this work, authorized by act of March 3, 1879, and approved January 31, 1880, and modified by act of September 19, 1890, in accordance with plans given in Annual Report of the Chief of Engineers, 1889, page 678, is to make a harbor of refuge at the entrance to New Haven Harbor by constructing four breakwaters—one 3,300 feet long, extending from Southwest ledge to Quixes ledge; one 5,000 feet long, extending from a point 1,000 feet north 54° east from Ludington rock, in a direction south 54° west across the rock; one about 4,200 feet long, extending northwesterly from a point 6,000 feet south 54° west from Ludington rock; and one about 1,200 feet long, extending southwesterly from Morgan Point, on the east side of the harbor entrance—the cross section of all these breakwaters to be 12 feet wide on top and 6 feet above mean high water, with outer slope 1 on 2 and inner slope 1 on 1. The estimated cost from the beginning, in 1880, was $2,151,134. The anchorage which will be sheltered by the breakwaters exceeds 2,000 acres, of which over 500 acres has depths of 20 to 28 feet, and the remainder is 9 to 20 feet deep. The mean rise of tide is 6.5 feet.

For original report on project see Annual Report of Chief of Engineers, 1880, page 449 et seq., and for modification of project and maps showing the location of the breakwaters as contemplated under the existing project see Annual Report of the Chief of Engineers for 1889, page 678 et seq.; 1890, pages 624 and 625; and 1896, page 702.

At the close of the fiscal year the breakwater from Southwest ledge to Quixes ledge had been completed 3,450 feet long; 4,450 feet of the Ludington rock breakwater had been built, but with steeper slopes

than called for by the project; and work was in progress on the west breakwater, which had been extended a total distance of 2,850 feet, of which the first 2,655 feet from the easterly end was very nearly completed and the remainder was about 5 feet below low water, The project is about 75 per cent completed.

The total expenditure to June 30, 1909, was $1,004,455.11, of which $8,751.91 was for maintenance.

The commerce now benefited and to be further benefited by this work is mainly the passing commerce of Long Island Sound. The projected breakwaters provide also an outer anchorage for vessels bound to and from New Haven and help to protect the entrance to New Haven Harbor proper from seas and to diminish channel filling. For the calendar year 1908 some 5,630 vessels sought refuge behind the breakwaters. The additional work proposed is for extension of benefit to commerce.

The available balance and the appropriation asked for will be applied to continuing construction of the west breakwater and to maintenance.

The river and harbor act of March 2, 1907, authorized continuing contracts for the prosecution of this work to the amount of $250,000, all of which has now been appropriated; such a contract was entered into June 11, 1907. Work under this contract was begun September 4, 1907, and was in progress at close of fiscal year.

July 1, 1908, balance unexpended	$170,070.45
June 30, 1909, amount expended during fiscal year for works of improvement	45,525.56
July 1, 1909, balance unexpended	124,544.89
July 1, 1909, outstanding liabilities	23,008.35
July 1, 1909, balance available	101,536.54
July 1, 1909, amount covered by uncompleted contracts	81,153.61
Amount (estimated) required for completion of existing project	1,030,885.91
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	100,000.00

NEW HAVEN HARBOR, INCLUDING WEST RIVER, CONNECTICUT.

New Haven Harbor is formed by a bay on the north side of Long Island Sound, which extends inland about 4 miles and is from 1 to 2 miles wide. Mill and Quinnipiac rivers, navigable for about 1 and 3 miles, respectively, above their mouths, empty into the head of the harbor from the northeast. The original available low-water depth from the wharves to Cranes bar, one-third way down the harbor, was 9 feet; thence to Fort Hale, halfway down, it was 16 feet or over Below Fort Hale was a broad bar of soft mud extending across the channel, with available depth of 13 feet. The harbor entrance was partly obstructed by several sunken rocks. In Quinnipiac River the available low-water depth was about 4 feet, and in the west branch of Mill River about 5 feet to the head of the present projected improvement. Above this point both rivers are for the most part available for navigation only at high tide. The entire east branch of Mill River ran nearly bare at low tide.

In 1870 a project was adopted for removal of sunken rocks at the harbor entrance. This work was not continued after 1875, when the harbor breakwaters were first proposed. In 1871 the project was

extended to include deepening the harbor channel, the proposed depth and width being modified from time to time as appropriations were made until 1899, when the project provided for a channel 16 feet deep and from 400 to 700 feet wide from Long Island Sound to the head of the harbor and for a dike to contract the channel across Fort Hale bar, at a total estimated cost from beginning of $348,000. This project was nearly completed, the deficiencies being in the length of channel arm of the dike, which was about two-thirds the projected length, and in the width of the channel across Fort Hale bar, which was only 200 feet wide. The total amount expended on these projects was $325,695.66.

The project adopted by the act of March 3, 1899, provided for a channel 20 feet deep, 400 feet wide, and 4 miles long from Long Island Sound to Canal dock; thence of same depth, 300 feet wide, one-half mile to Tomlinson Bridge; three anchorage basins below Tomlinson bridge of 20, 16, and 12 feet depths; a channel up the Quinnipiac River 200 feet wide and 12 feet deep to Grand avenue; and a channel up the Mill River 12 feet deep and 200 feet wide to the junction of the two branches above Chapel street, and thence 12 feet deep and 75 feet wide up each branch to Grand avenue. The act of March 3, 1899, making the first appropriation for this project, limited it to the portion below Tomlinson Bridge, but the act of June 13, 1902, authorized the extension to the part above Tomlinson Bridge, provided the cost should not exceed $345,000, the amount authorized by the act of 1899. The above project, including the improvement of the Quinnipiac and Mill rivers, except that part of the Quinnipiac River between Ferry street and Grand avenue, was completed April 26, 1904, mainly under continuing contract, and a channel 8 feet deep and 50 feet wide dredged in the Quinnipiac River between Ferry street and Grand avenue. The total appropriated for the project adopted by the act of 1899, exclusive of maintenance, amounts to $280,073.90, being less than the authorized cost of the project by $64,926.10.

For reference to maps and further details regarding the harbor and projects, see Annual Report of the Chief of Engineers, 1904, page 94.

West River lies between the city of New Haven and the town of West Haven. The head of navigation is at a railroad bridge about one-half mile upstream from the Kimberly Avenue Bridge. About 500 yards below this drawbridge the river widens into a shallow bay and joins New Haven Harbor south of Oyster or City Point. The natural channel, about 2,000 yards long through the middle of the bar, carried less than 3 feet at its shoalest part. A channel leading from the harbor to docks at Oyster Point had a controlling depth of 4.5 feet, but between Oyster Point and the channel along the West Haven docks was a wide flat nearly bare at low tide.

The project adopted by the river and harbor act of March 3, 1905, for improvement of West River, provided for a 9-foot channel, 100 feet wide, from the downstream corner of the 16-foot anchorage basin of New Haven Harbor, via Oyster Point and the dock frontage of West Haven, to Kimberly Avenue Bridge, at a cost of $38,500, and $500 for annual maintenance.

The report of survey of West River is published at page 996 and following, Annual Report of the Chief of Engineers, 1904, and the survey map is printed in House Document No. 73, Fifty-eighth Congress, second session.

The river and harbor act of March 2, 1907, consolidated the improvement of West River with that of the main harbor, of which the former is a branch.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1909, was $350,025.07, of which $38,318.86 was for maintenance. Of the amount reported expended on existing project $38,500 was expended on West River prior to its consolidation with the general project.

The project of 1899 for the main harbor is about 80 per cent completed and the channel in West River contemplated by the project of 1905 completed.

The maximum draft which could be carried June 30, 1909, through the main channel to Tomlinson bridge was 19 feet at mean low tide; above Tomlinson bridge the maximum low-water draft which could be carried up Mill River to Grand Avenue Bridge was 12 feet in both branches; up Quinnipiac River to Ferry Street Bridge 12 feet, and from Ferry Street Bridge to Grant avenue a little more than 6 feet; and up West River to Kimberly avenue 9 feet. The mean rise of tide is 6.5 feet at entrance to the harbor and 6.6 feet at Tomlinson bridge.

The work done has enabled deeper-draft vessels to use the harbor than was formerly possible, with the resulting reduction of freight rates due to the larger vessels and increased facilities for handling freight made possible thereby.

The commerce of New Haven Harbor is mainly in coal, steamboat freight, shellfish and shells, lumber, steel billets, and pig iron. The reported tonnage for the calendar year 1908 was 1,921,123 tons, valued at $98,233,543.22.

The available balance and the appropriation asked for will be applied to maintenance and to continuing the approved project.

July 1, 1908, balance unexpended	$2,083.44
Amount allotted from emergency appropriation, river and harbor act approved March 2, 1907	3,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	20,000.00
	25,083.44
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	5,230.27
July 1, 1909, balance unexpended	19,853.17
July 1, 1909, outstanding liabilities	83.00
July 1, 1909, balance available	19,770.17
July 1, 1909, amount covered by uncompleted contracts	10,668.00
Amount (estimated) required for completion of existing project	64,926.10
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	40,000.00

Report on a recent survey is printed in House Document No. 1159, Sixtieth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 5, 1908.

SIR: I have the honor to submit herewith for transmission to Congress reports of May 15, 1907, and July 31, 1908, with map, by Maj. Harry Taylor, Corps of Engineers, on preliminary examination and survey, respectively, authorized by the river and

harbor act approved March 2, 1907, of New Haven Harbor, Connecticut, with a view to determining whether a greater depth is needed; also the rocks in Morris Cove.

New Haven Harbor has been under improvement by the United States since 1870, the present project providing for a depth in the main channel of 20 feet at mean low water with certain anchorage areas and tributary channels of the same and less depths.

For the reasons given in the survey report of July 31, 1908, it appears that no increase in the general project depth is necessary at the present time. An increase to 15 feet in the 12-foot anchorage basin and to 12 feet in the channel about 1,500 feet long toward Brewery street on the east side of the Canal Dock, together with the necessary dredging to restore the project depth of 20 feet in the main channel and the removal of the rocks in Morris Cove (mentioned in the item of the act of March 2, 1907, referred to above), are all recommended by Major Taylor, the estimated cost of this work (in round numbers) being $68,000.

I concur in the opinion of the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors that New Haven Harbor is worthy of further improvement to this extent.

In addition to the above, Major Taylor includes in his survey report an estimate amounting to $212,000 (including contingencies) as the cost of widening the main 20-foot channel from Tomlinson Bridge downstream about 6,000 feet. The item of the law containing provision for this investigation specifies that it shall be made "with a view to determining whether a greater depth is needed," but makes no reference to the necessity for greater channel widths. While, therefore, under a strict interpretation of the wording of the act referred to this latter estimate should have no place in this report, in view of the fact that this additional width of channel is recommended by the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors, I am constrained to permit the estimate to stand as submitted, thus leaving it to the proper committees of Congress for such consideration as in their estimation it should receive.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

The local commerce of New Haven is large, and it is the center of distribution for a large amount of commerce to northern Connecticut and central New England, the commerce of the port amounting to approximately 2,000,000 tons per annum. It is claimed, and apparently with reason, that the commerce is now handicapped, due to the lack of depth, and that if greater depth were provided in the harbor not only would the commerce be materially increased, but freight rates would be largely reduced. As compared with Bridgeport and New London, one west of New Haven and the other east, New Haven is handicapped in the depth of its harbor, as the present project provides for 22 feet in the main channel at Bridgeport and New London Harbor has already been improved so as to give 23 feet to the wharves. The commerce of both these harbors together is less than that of New Haven.

NEW LONDON HARBOR, CONNECTICUT.

Shaws Cove is a small portion of New London Harbor, lying on the west side of the harbor, between the main part of the city of New London and Fort Trumbull.

The dredging in this section of New London Harbor was completed to project depth of 12 feet in 1899; in 1905, 11,095 cubic yards was removed under a contract for dredging for maintenance. The portion of the harbor which was redredged in 1905 has maintained its depth practically to the full project depth; the other sections of the harbor have shoaled somewhat.

Situated on the cove are three coal yards, one lumber yard, and one stone yard, which receive their supplies by water. At the south end of the cove is located a foundry, the owners of which state that if

there were sufficient depth they would also receive coal and iron by water. The commerce of the cove for the calendar year 1906, as reported by the coal, lumber, and stone yards, amounted to 20,829 tons, valued at $126,912.70. The main industry, however, on Shaws Cove is the repair of and caring for pleasure yachts which are laid up here during the winter, almost the entire west side of the cove being lined with wharves which are devoted to this business.

The commerce of this cove is increasing, and, due to the draft of vessels now bringing coal, lumber, and stone to this port, the increase of depth asked for is necessary.

The following report of the Board of Engineers is concurred in by the Chief of Engineers and printed in House Document No. 329, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., October 28, 1907.

Respectfully returned to the Chief of Engineers, U. S. Army.

From the district officer's report on a survey of Shaws Cove, New London Harbor, and the map accompanying, it appears that to restore the present project depth of 12 feet will require the removal of about 6,000 cubic yards, at a cost of about $1,000, and that to increase the harbor depth to 15 feet, as contemplated in the act, will cost about $11,000 additional, or a total of about $12,000, and that the improvement can then be maintained by the expenditure of $3,000 at intervals of ten years, or an annual expenditure of $300.

Believing that the advantages to be gained by the increased facilities proposed will bear a fair relation to the cost, the Board concurs with the district officer and the division engineer in recommending the adoption of the project outlined within at an initial cost of $12,000.

NORWALK HARBOR, CONNECTICUT.

This harbor consists of the tidal part of Norwalk River extending from Norwalk, the head of navigation, to the river mouth, about 3 miles, and of an outer or main harbor lying between Norwalk Islands and the mainland. South Norwalk is on the west bank, about 1½ miles below Norwalk. The original depth in the river up to South Norwalk was about 5 feet; between there and Norwalk the river bed was nearly bare at low tide.

The sum of $80 was expended in the year 1829 in making a survey of the harbor in accordance with the act of Congress approved March 2 of that year.

The original project, adopted under the act of June 10, 1872, and modified by the terms of the act of June 14, 1880, provided for a channel 100 feet wide and 8 feet deep from the outer harbor to South Norwalk, and thence 6 feet deep to Norwalk. This project was considered completed in 1892 at a cost of $83,000, although portions of the channel between Norwalk and South Norwalk were only 60 feet wide. The act of August 18, 1894, appropriated $15,000 for improving the inner harbor, and indicated the points where work was to be done. In accordance therewith a project was adopted for removing to 6 feet depth the shoal at Ferrys Point, below Norwalk, and, if funds permitted, for widening with depth of 9 feet the bend at Keysers Island, near the river mouth. This project was completed in 1897 at a cost of $15,000. A project adopted by the act of June 3, 1896, provided for a channel 10 feet deep and 150 feet wide from the outer harbor to South Norwalk, widening two points near the entrance, and the maintenance of this channel and the 6-foot channel

between South Norwalk and Norwalk, at estimated first cost of $62,000, and $2,000 annually for maintenance. This project was completed October 3, 1905; the amount expended on it was $36,833, of which $15,516.89 was expended for maintenance.

The present project, adopted by the act of March 2, 1907, provides for the restoration of the channel 10 feet deep and 150 feet wide to South Norwalk, for a channel 8 feet deep of a general width of 100 feet from South Norwalk to Norwalk, and for a channel 6 feet deep, 2,900 feet long, of a general width of 75 feet, to the docks at East Norwalk, and for maintenance of these channels, at an estimated first cost of $65,500, and $8,000 per annum for maintenance.

Channels of the full dimensions called for by this project were completed September 19, 1908. The amount expended on this project to June 30, 1909, was $52,963.43, of which $8,858.41 was expended for maintenance.

The maximum draft that could be carried at low water June 30, 1909, to the South Norwalk docks was 10 feet, to the Norwalk docks 8 feet, and to the East Norwalk docks 6 feet. The mean rise of tide is 7.1 feet.

The available balance and the appropriation asked for will be applied to maintenance of the improvements.

The commerce of this harbor is mainly in coal, oysters, lumber, wood pulp, building material, and general merchandise, and on all these items the improvement has effected a material reduction in freight rates. The reported tonnage for calendar year 1908 amounted to 199,465 tons, valued at $19,359,751.28.

July 1, 1908, balance unexpended		$36,268.99
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$25,236.09	
For maintenance of improvement	496.33	
		25,732.42
July 1, 1909, balance unexpended		10,536.57
July 1, 1909, outstanding liabilities		21.52
July 1, 1909, balance available		10,515.05
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		8,000.00

CONNECTICUT RIVER BELOW HARTFORD, CONN.

The part of the river under improvement is 50 miles long from Long Island Sound to Hartford. Beyond Hartford the river is navigable, by means of a small private canal at Windsor Locks, Conn., 34 miles to Holyoke, Mass., although the navigation is limited by reason of low fixed bridges and the inadequacy of the canal. Before beginning improvement below Hartford the available depth over Saybrook bar at the mouth of the river was 7 feet, and thence to Hartford at the shoalest of the river bars about 5 feet.

The original project, adopted in 1836, provided for the removal of the Saybrook bar by dredging. Up to 1843 an 11 to 12 foot channel had been dredged 50 feet wide and 1,500 feet long, at a cost of $23,471.57. No further work was done until 1870, by which time the dredged channel had been nearly obliterated by storms and freshets.

A project for permanent improvement was adopted in 1870 and modified in 1873 and 1880, under which two jetties were built at Saybrook bar and dikes constructed at Hartford and Glastonbury bars; but operations under this project have been abandoned.

The existing project, adopted in 1887 and modified in 1890, provides for maintaining the navigable channel by completing two jetties at Saybrook bar to a height of 5 feet above high water, with top width of 6 feet and side slopes of 1 on 1; raising the training wall, nearly 3,700 feet long, at the Hartford bars as may be found necessary by experience but not to exceed 15 feet above low water; dredging the channel between the jetties to 12 feet depth and width of 400 feet and maintaining the channel by annual dredging at the various river bars to about 10 feet depth at mean low water and to a width as near 100 feet as practicable, at an estimated cost—

Completing Saybrook jetties	$60,000
Dredging channel between them	20,000
Raising Hartford dike	50,000
Total	130,000

and $10,000 annually for dredging for maintenance.

For scope and history of the modifications, see pages 120 and 121, Annual Report of the Chief of Engineers for 1900.

The act of June 13, 1902, authorized an expenditure of $1,000 for removal of obstructions at mouth of Salmon River, a tributary to the Connecticut River.

Up to June 30, 1909, $590,300.24 had been expended on this improvement, of which $338,157.62 had been applied to maintenance. The project is about 50 per cent completed.

The maintenance of the river-bar channels by annual dredging has been held paramount in the project. A channel 200 feet wide and 12 feet deep at mean low water, which has been dredged through Saybrook bar between the jetties, has been well maintained by the jetties, and annual dredging at the river bars has generally kept a half-width channel open so that Hartford-New York steamers and barges drawing from 9 to 11 feet, according to the river stage, have been but little detained, and then only at summer low river and before completion of the annual dredging. The maximum draft which could be carried at mean low water over the shoalest river bar on June 30, 1909, was 10 feet. The mean rise of tide is 3.6 feet at Saybrook jetties and on low river 1.5 feet at Hartford.

Sketches of the Connecticut River from Hartford to Rocky Hill and of Saybrook bar are printed in the Annual Report of the Chief of Engineers for 1885, page 636. The river from the Sound to Hartford is shown on Coast Survey charts 253–256.

The reported tonnage for the year 1908 amounted to 515,581 tons, mainly coal, lumber, building materials, and miscellaneous steamboat freight, valued at $14,001,989.

The work done has reduced freight rates to Hartford and lower river ports materially, and has also greatly facilitated the delivery of coal and other freight. Without the improvements there could be but little freight traffic on the river.

The available balance and the additional appropriation asked for will be applied to maintenance and continuing work on the approved project.

July 1, 1908, balance unexpended		$32,976.50
Amount allotted from appropriation by river and harbor act approved March 3, 1909		15,000.00
		47,976.50
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$13,815.77	
For maintenance of improvement	12,762.54	
		26,578.31
July 1, 1909, balance unexpended		21,398.19
July 1, 1909, outstanding liabilities		4,885.51
July 1, 1909, balance available		16,512.68
July 1, 1909, amount covered by uncompleted contracts		8,227.45
Amount (estimated) required for completion of existing project		95,665.68
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		42,000.00

EIGHTMILE RIVER, ETC., CONNECTICUT RIVER, CONNECTICUT.

Eightmile River, otherwise known as Hamburg Cove, empties into the Connecticut River from the east about 8 miles above Saybrook Point.

The entrance to Eightmile River is through a comparatively straight channel about 1,700 feet long and 50 feet wide, with a depth of 9 to 10 feet at low water. At the inner end the channel shoals to about 6½ feet for a distance of approximately 200 feet. Beyond this point, extending about half a mile, there is a large body of water, known locally as the "Bay," which has a width of from 700 to 1,200 feet and a depth of from 15 to 25 feet. At the inner end of this bay the channel becomes narrow and shoal, and from this point to the town of Hamburg, a distance of three-fourths of a mile, there are places in the channel where it is so shoal as to prevent navigation by anything but extremely shallow-draft craft.

Eightmile River is the natural outlet for the farm and timber products of a large territory extending for 8 or 10 miles back of Hamburg village. The nearest railroad station to Hamburg is at Lyme, a station on the New York, New Haven and Hartford Railroad, about 6 miles distant. The road to Lyme is a very poor one, rough and sandy, with many steep hills. In former years, when the Eightmile River was navigable to Hamburg, it is stated that from 40 to 70 vessels of lumber, wood, and ties, etc., were annually shipped from that point, and it is stated that during the year 1889 about 80 vessel loads were shipped, the vessels carrying from 65 to 200 tons each. Last year, 1906, there were 5 large schooner loads of ties shipped, but due to the condition of the channel these schooners could not come above the broad, deep part of the bay, and great inconvenience and considerable extra expense was caused by this fact.

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers, and printed in House Document No. 327, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., October 28, 1907.

Respectfully returned to the Chief of Engineers, U. S. Army.

The district officer suggests as a suitable channel to meet the demands of navigation on this stream one having a width of 75 feet and a depth of 8 feet at mean low water.

He estimates the cost of providing such a channel at $9,000, and states that its maintenance will probably not exceed $1,000 in ten years. The district officer and the division engineer unite in recommending favorably the improvement proposed.

Believing that the estimated cost of the work is reasonable when compared with the probable resulting benefits to navigation, the Board concurs in the views of these officers, and recommends the adoption of the project as proposed within.

HOUSATONIC RIVER, CONNECTICUT.

This is a rapid river running southward through Massachusetts and Connecticut, emptying into Long Island Sound east of Stratford Point, about 5 miles east from Bridgeport Harbor. At Derby, 13 miles from its mouth, it receives the discharge of the Naugatuck River. Derby and Shelton are at the head of navigation. About a mile above there is a large power dam across the Housatonic River; above the pool of this dam the river is rocky and shoal.

The original depth on the worst bars in the river (6 in number) was from 3.5 to 4.5 feet. There was also a bar across the river mouth, with about 4 feet depth.

The original project for improvement, adopted under the act of March 3, 1871, provided for a jetty at Sow and Pigs reef; removing Drews rock; a breakwater at the mouth of the river; and making a channel 7 feet deep, 200 feet wide through the bar at the mouth and 150 feet wide in the river, at a total estimated cost of $404,961. In 1887 the estimates were revised, and a modification of the project proposed a breakwater or jetty at the mouth of the river 5,750 feet long, extending about south-southeast from Milford Beach 3,250 feet; thence parallel to and 500 feet from the channel 2,500 feet farther, to the 12-foot curve in Long Island Sound, the inner arm of the jetty to be 3 feet above mean low water, top width 6 feet, side slopes 1 on 1; the outer arm to be 6 feet above high water, top width 12 feet, outer slope 1 on 2, inner slope 1 on 1; and a channel 7 feet deep, 200 feet wide at the outer bar, and 100 feet wide through the river, at a total estimated cost of $202,000, and $4,000 annually for maintenance, all in addition to amount already expended. This modification was adopted under the act of August 11, 1888, and work on the breakwater was begun July 10, 1889. In 1893 the project was further modified to provide for building a small dike in the river below Stratford.

For maps see Annual Report of the Chief of Engineers for 1882, page 616, and for reports on various surveys and projects see Annual Reports of the Chief of Engineers for 1871, page 781; 1887, Part 1, page 607; 1888, Part 1, page 554.

The present project for improvement is the project of 1871, subsequently enlarged or modified as above, and the estimated cost from the beginning is $275,500.

Up to June 30, 1909, $272,450 had been expended on this project, of which $73,751.03 had been applied to maintenance. At that date the project was completed, except that the dike below Stratford was not built to the full projected length and the outer arm of the breakwater was only about 4 feet high above high water, 5 feet wide on top, and the side slopes much steeper than called for by the project. A channel of project dimensions had been dredged from the mouth of the river to Derby, but had deteriorated from the action of spring freshets and been redredged from time to time.

On June 30, 1909, 7 feet draft at mean low water could be carried across the outer bar and thence to Derby. The mean rise of tide at Derby is 4.2 and at the mouth of the river about 6.3 feet. The work done has enabled vessels to enter the lower river in safety instead of waiting for high tide in an exposed situation outside. A large part of the commerce could not have been carried on without the improved channel. The navigable channel to Derby materially reduces freight rates at that and adjacent towns, as otherwise all freight would have to be handled by rail and with no competition.

The commerce is largely in coal. A considerable quantity of oyster shells is shipped from near the mouth of the river. The reported tonnage for the calendar year 1908 was 77,895, valued at $378,980.52.

The available balance and the appropriation asked for will be applied to redredging at the bar channels, where needed, and in continuing work on the breakwater.

July 1, 1908, balance unexpended		$9,976.78
Amount allotted from appropriation by river and harbor act approved March 3, 1909		5,000.00
		14,976.78
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$9,501.33	
For maintenance of improvement	475.45	
		9,976.78
July 1, 1909, balance unexpended		5,000.00
July 1, 1909, outstanding liabilities		1.65
July 1, 1909, balance available		4,998.35
July 1, 1909, amount covered by uncompleted contracts		4,900.00
Amount (estimated) required for completion of existing project		76,325.58
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		45,000.00

THAMES AND SHETUCKET RIVERS, CONNECTICUT.

Thames River is a tidal stream from Norwich, Conn., the head of navigation, to Long Island Sound, a distance of 15 miles. For 4 miles below Norwich the natural depths were 6 feet or more at low water, with widths of 400 to 1,000 feet. Below this point depths were 13 feet or more and widths 800 to 3,000 feet.

The original project, adopted in 1836, provided for a channel 11 feet deep at low water, to be secured by dredging and building dikes. On this project $40,300 had been expended when, in 1839, work was stopped, the project not having been completed.

The existing project, adopted June 23, 1866, and modified in 1879, 1882, 1888, 1892, and 1907, is to dredge and build training walls to secure a channel 200 feet wide with depths of 20 feet from New London to Allyns Point and 14 feet thence 5 miles to Norwich; also to dredge Shaws Cove at New London to a depth of 12 feet. Estimates of cost were $473,870 for construction and $9,500 annually for maintenance.

Up to June 30, 1909, $472,151.76 had been expended on this project and its modifications, of which $32,308.57 had been applied to maintenance. The project had been completed, except that part of the

channel between Allyns Point and Norwich was somewhat deficient in width. Mean range of tide is 2.6 feet at New London and 3.1 feet at Norwich.

The balance on hand and the appropriation recommended will be applied to maintenance of the improvement.

Commerce at Allyns Point is coal, and at Norwich and intermediate landings it is mainly coal, lumber, cotton and wool, and steamboat freight. The reported tonnage for 1908 was 443,395, valued at $2,265,350.51, including 22,561 tons, valued at $121,380.50, for Shaws Cove commerce.

The work done has reduced the cost of transportation by enabling freight to be brought in vessels of 16 and 18 foot draft instead of 8-foot draft. The river commerce of the present day could not be carried except for the increased depths thus obtained.

The modification of project adopted by act of March 2, 1907, is printed in House Document No. 265, Fifty-ninth Congress, second session.

July 1, 1908, balance unexpended	$29,434.69
June 30, 1909, amount expended during fiscal year, for works of improvement	13,986.45
July 1, 1909, balance unexpended	15,448.24
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

Report on a recent survey of Shetucket River is printed in House Document No. 397, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, November 17, 1909.

SIR: I have the honor to submit herewith, for transmission to Congress, reports of May 27 and August 31, 1909, with map, on preliminary examination and survey, respectively, of Shetucket River, Connecticut, from a point just south of the Laurel Hill bridge to the dock of the city of Norwich, with a view to removing rocks and other obstructions in the channel, authorized by the river and harbor act of March 3, 1909.

The dock of the city of Norwich is on Shetucket River about 500 feet upstream from the Thames River, between which and the Thames there is ample depth of water for navigation, except at two points, where there are obstructing rocks with a depth of water over them of about 6 feet at low tide, the channel between the rocks having approximately a 12-foot depth at low water and a width of 30 feet. The district officer states that, because of the currents and the location of the rocks with reference to each other, navigating a boat between them is exceedingly difficult, and he considers it in the interest of the navigation of the river to remove the rocks, one to a depth of 9 and the other to a depth of 12 feet, at an estimated cost of $1,500.

I concur with the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors, that the locality is worthy of improvement as proposed.

As the navigation of the Shetucket and Thames rivers is so intimately related, it is recommended that the project for the latter stream be extended to include the work proposed.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

BLACK ROCK HARBOR AND CHANNEL, NEW YORK.

Black Rock Harbor is in reality a canal built along the east bank of Niagara River, separated therefrom by Bird Island pier and Squaw Island, and having at its lower end a lock of 5 feet lift, 36 feet wide

by 200 feet long, and a depth of 9½ feet on miter sills at mean lake level. This harbor, or canal, was separated from the Erie Canal by a wall of stone and earth, and was constructed as a terminal for the Erie Canal.

From 1829 to 1834 appropriations amounting to $52,098 were made by the United States and applied to the construction of the Bird Island pier or breakwater.

The object of the present project is to provide a channel for deep-draft vessels between Buffalo and Tonawanda around the rapids at the head of Niagara River. This is to be accomplished by making a channel 200 feet wide and 23 feet deep at mean lake level, joining at the foot of Maryland street, Buffalo, the 23-foot channel completed in 1908, the proposed channel to extend westerly and northerly, through Black Rock Harbor and Erie Canal combined, to the present lock, below which a ship lock of the requisite capacity is to be built, the channel to extend from the foot of the ship lock through the Niagara River to deep water above Tonawanda, 400 feet wide and 23 feet deep at mean river level. The estimated cost is $4,500,000. The project contemplated a lock 600 feet in length and 60 feet in width between quoins; but in order to accommodate vessels of the largest size now in use and under construction which may desire to use it the dimensions of the lock have been increased to 650 feet in length and 70 feet in width.

Report of survey is printed on page 3284 et seq. of report for 1904.

Lands and structures needed in the prosecution of the work have been granted to the United States by the State of New York.

Continuing contracts were authorized by the river and harbor acts of March 3, 1905, and March 2, 1907, in the sum of $2,700,000 (all of which has since been appropriated) for prosecuting the project, and such contracts have been made as follows:

For the excavation of the southerly 6,400 feet, more or less, of the channel, to be completed December 31, 1908.

For the excavation of the next northerly 3,400 feet, more or less, of the channel, to be completed December 31, 1910.

For the construction of concrete walls for the ship lock, to be completed June 30, 1912.

During the fiscal year the cofferdam for lock walls was completed, unwatered, and excavation therein to bed rock nearly completed, and channel excavation was continued under existing contracts.

The total amount expended to June 30, 1909, was $991,390. The project is about 20 per cent completed.

The appropriation recommended will be applied toward payments under existing contracts, to construction of lock gates and machinery, and to further prosecution of the project, including construction of a bridge at Ferry street, Buffalo, and the excavation of the east channel of the Niagara River from the foot of the ship lock to the natural deep-water harbor 2½ miles downstream. It is recommended that the entire amount ($1,800,000) required to complete this project be made available, $1,000,000 by cash appropriation for the year ending June 30, 1911, and $800,000 by continuing contract authorization.

The maximum draft that could be carried June 30, 1909, at mean lake level, over the shoalest part of the locality under improvement, was 8 feet, and the usual variation of water surface is from 3 to 4 feet.

The project, being auxiliary to the improvement at Buffalo, has not, as a separate work, affected freight rates.

The locality is shown on United States Lake Survey Chart No. 312.

For commercial statistics see report on Buffalo Harbor.

July 1, 1908, balance unexpended	$1,469,662.35
June 30, 1909, receipts from sales	1.00
Amount appropriated by sundry civil act approved March 4, 1909	1,000,000.00
	2,469,663.35
June 30, 1909, amount expended during fiscal year, for works of improvement	708,633.10
July 1, 1909, balance unexpended	1,761,030.25
July 1, 1909, amount covered by uncompleted contracts	1,451,760.75
Amount (estimated) required for completion of existing project	1,800,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	1,000,000.00

BUFFALO HARBOR, NEW YORK.

The following is from Rivers and Harbors Committee, Document No. 2, Sixty-first Congress, second session:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, January 11, 1910.

SIR: Acknowledging receipt of your letter dated December 7, 1909, inclosing resolution of the committee of the same date relative to a review of the report on Buffalo Harbor, New York, with a view to the removal of the Watson elevator site, I have the honor to transmit herewith a copy of the report of the Board of Engineers for Rivers and Harbors, dated the 10th instant, in response thereto.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

Hon. D. S. ALEXANDER,
Chairman Committee on Rivers and Harbors,
United States House of Representatives.

WAR DEPARTMENT,
BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., January 10, 1910.

SIR: 1. The Board has the honor to submit its report in response to the following resolution of the Committee on Rivers and Harbors of the House of Representatives:

"*Resolved by the Committee on Rivers and Harbors of the House of Representatives,* That the Board of Engineers for Rivers and Harbors, created under the act of June thirteenth, nineteen hundred and two, be requested to review the report on Buffalo Harbor, New York, with a view to the removal of the Watson elevator site, made in accordance with the provisions of the river and harbor act approved March third, nineteen hundred and nine."

2. The report referred to in the resolution was submitted September 13, 1909, in compliance with an item contained in the act of March 3, 1909, as follows:

"Buffalo Harbor, with a view to widening the channel at the entrance of the inner harbor, and also an estimate of the cost of the removal of the Watson elevator site, exclusive of the cost of acquiring title to the same."

3. Based upon the information available at the time of its former report the Board expressed the opinion that it was not advisable for the General Government to undertake the removal of the Watson elevator site. The estimated cost of the work involved was $62,205, including an item of $11,250 for a retaining wall or bulkhead.

4. As a result of the resolution above quoted and with a view to securing additional data, coupled with a request from interested parties, a committee of the Board made an inspection of the locality and held a public hearing on December 29, 1909.

5. From the representations made to the committee and from papers submitted, it appears that this work is one which is of interest to lake commerce arriving at and departing from Buffalo from and to all the various lake ports. The improvement desired is therefore one which would appear to be, to a certain extent at least, in the interests of the general navigation of the Great Lakes, and while situated at Buffalo, can not be wholly considered as a local improvement.

6. There seems to be no question that the removal of the Watson elevator site is necessary in the interests of navigation, in view of the numerous accidents which occur in the vicinity of this site and of the congested condition of the channel way during the season of navigation. Moreover, it is claimed by interested parties, vessel men and others, that this excavation is not desired for a turning basin, but simply on account of the difficulties of navigation at this point in entering or leaving Buffalo River or the city ship channel, and in this view the Board now concurs.

7. The city of Buffalo has purchased the site in question, and in fact all the land between the point and the Peck Slip. The city is prepared to deed to the United States free of cost the site to be excavated, and to relinquish control of the waterway between the line drawn across the channel at the back limit of the excavation and the present limiting line dividing the part maintained by the United States from that now maintained by the city.

8. The law practically limits the consideration by the Board of the excavation of the Watson property only. The interests involved desire the excavation to be carried back to cover land not belonging to this estate, and in fact as far as the first channel way beyond the Watson property connecting the city ship channel with the Buffalo River. If this were done, it would eliminate the necessity for the bulkhead, estimated to cost $11,250. If this additional area can be excavated for that amount, there would be no objection thereto, provided authorization of Congress is given therefor. In view of the facts laid before it at the meeting at Buffalo, the Board now recommends that the work outlined above be done by the United States at an estimated cost of $62,203, with or without the substitution of greater excavation, with the elimination of the bulkhead as indicated above, as Congress may decide, provided that the site shall be deeded to the United States free of cost and the control of the channel to the upper limit of the proposed excavation shall also be relinquished to the General Government.

9. While recommending this work to be done by the United States, the Board desires to call attention to the fact that the river and harbor bill of March 3, 1909, provided as follows:

"The Secretary of War is authorized to appoint a board of engineers to examine those harbors on the Great Lakes and elsewhere in which the whole or a part of the harbor is improved at local expense, which board shall make recommendations with a view to determining whether the improvements so made by local authorities should be undertaken or maintained by the General Government and to establishing uniform rules in making harbor improvements."

This Board is not informed as yet of the conclusions of the special board appointed under the provisions just quoted, but desires to call attention to the fact that the recommendation above made should be subject to any policy which Congress may adopt as a result of the report of the special board.

For the Board:

Very respectfully,

WM. T. ROSSELL,
Colonel, Corps of Engineers,
Senior Member of the Board.

The CHIEF OF ENGINEERS, U. S. ARMY,
Washington, D. C.

The commerce of Buffalo is large. During the year 1908 arrivals and departures of vessels by lake and river aggregated in number 6,191 and in tonnage 12,003,968.

The arrivals and departures of canal boats by the Erie Canal were 4,482 in number, with a tonnage of 1,621,527.

The principal receipts by lake and river were wheat, corn, flour, oats, iron ore, lumber, copper, pig iron, glucose, lard, and pork. The total receipts amounted to 7,526,615 tons.

The shipments by lake were principally coal, sugar, salt, and cement, and aggregated 4,652,259 tons.

For comparison the following table is given, showing the arrivals and departures by lake and canal and the tonnage for the past five years:

Year.	Lake.		Canal.	
	Number.	Tons.	Number.	Tons.
1904	7,375	10,783,980	5,132	988,725
1905	7,950	12,090,153	4,902	985,861
1906	8,294	13,876,759	5,666	1,769,919
1907	8,205	14,578,233	5,014	1,942,455
1908	6,191	12,178,874	4,482	1,621,527

Total shipments and receipts: 1907, 18,429,695 tons; 1908, 13,800,401 tons.

HARBOR AT CAPE VINCENT, NEW YORK.

This harbor in its original condition was an open roadstead on the St. Lawrence River, 2½ miles from Lake Ontario, and is a convenient location for vessels to lie during storms, at night, and in thick weather.

The original project of 1896 was to build a breakwater, 1,600 feet long, parallel to and 600 feet from the railroad wharf, at an estimated cost of $320,000. On May 13, 1899, this project was modified to build a breakwater parallel to and 500 feet from the railroad wharf, 1,550 feet long, of which length 150 feet, or so much thereof as required, was to be a shore return at upper end, at an estimated cost of $200,000. Nine hundred and ten feet of this breakwater, of which 50 feet is shore return, has been built. Further extension of the shore return is not considered necessary. The project is about three-fifths completed. No work was done during the fiscal year. There was $128.62 expended for pay of watchman and for traveling expenses.

The amount expended to June 30, 1909, was $127,279.79, of which $270.39 was for maintenance.

The maximum draft that could be carried over the locality under improvement at low water June 30, 1909, was 19 feet, and the usual variation of level of water surface is 3 feet.

The commerce of Cape Vincent is not large. This improvement is intended to make a harbor of refuge for all craft plying between Lake Ontario and the St. Lawrence River.

The following is a statement of the commerce of this port, in tons, for the years given: 1901, 4,209; 1902, 4,175; 1903, 15,666; 1904, 20,083; 1905, 21,750; 1906, 112,501; 1907, 21,946; 1908, 33,573.

Work proposed for the next fiscal year is the continuation of the breakwater, and the amount asked for will be applied to this work for the purpose of extension of benefits.

The project has provided facilities that make navigation more safe, and thus affects freight rates.

July 1, 1908, balance unexpended	$848.83
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	128.62
July 1, 1909, balance unexpended	720.21
Amount (estimated) required for completion of existing project	72,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	72,000.00

HARBOR AT CHARLOTTE, NEW YORK.

This harbor is at the mouth of the Genesee River. In its original condition vessels of more than 8 feet draft could not cross the bar.

The original project of 1829 was to secure a channel 12 feet deep across the bar by constructing parallel piers to confine and direct the action of the spring freshets. The project of 1882 was to obtain a depth of 15 feet by extending the two piers a total of 3,250 feet and by dredging. After the piers had been extended 1,444 feet the project was modified July 18, 1896, to preserve the depth by dredging without further extension of the piers for the present, and March 2, 1897, it was again modified to obtain and maintain not less than 16 feet and not more than 16½ feet at low water (zero of Oswego gauge) in a channel not more than 200 feet wide.

The piers are nearly parallel, about 450 feet apart. The west pier is 3,616 feet and the east pier 3,109 feet in length, projecting beyond the shore line 2,230 and 2,200 feet, respectively. During the fiscal year 812 feet of the east pier and 59 feet of the west pier received concrete superstructure, making a total to June 30, 1909, of 1,532 feet of east and 1,559 feet of west pier with concrete superstructure. The entrance channel was maintained during the year. Project completed except maintenance.

The amount expended to June 30, 1909, was $750,987.25. It is impossible to separate the cost of construction and maintenance.

June 30, 1909, the maximum draft that could be carried in the channel at low water was 16 feet, and the usual variation of level of water surface is 3 feet.

The Genesee River is navigable for lake vessels for a distance of about 2½ miles above its mouth.

It is reported that the project has a material effect in controlling freight rates on bulk commodities, such as coal, grain, lumber, and ore.

The following is a statement of the commerce at this port during the past ten years, in tons: 1899, 447,428; 1900, 388,605; 1901, 549,207; 1902, 557,690; 1903, 569,169; 1904, 554,212; 1905, 597,996; 1906, 432,709; 1907, 701,916; 1908, 709,950.

The work proposed for the ensuing fiscal year, to make the improvement available, is to make necessary repairs to piers and to dredge the channel when required, and the appropriation recommended will be applied to this purpose, with the allotment of $9,000, made from emergency funds May 24, 1909.

July 1, 1908, balance unexpended	$37,166.32
Allotted from emergency appropriation, act of March 3, 1905	9,000.00
Sales	4.10
	46,170.42
June 30, 1909, amount expended during fiscal year for maintenance of improvement	36,500.41
July 1, 1909, balance unexpended	9,670.01
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	80,000.00

Report on a recent survey is printed in House document No. 342, Sixty-first Congress, second session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., July 26, 1909.

Respectfully returned to the Chief of Engineers, U. S. Army.

From the within report it appears that it will cost $31,680 to increase the depth of Charlotte Harbor from the present project depth of 16½ feet to a navigable depth of 18 feet. The district officer believes the locality worthy of this additional improvement.

To June 30, 1908, there had been expended on this harbor $714,938.47. The commerce involved is considerable in extent and reasonably permanent in character. It averaged for the years 1894, 1895, and 1896, 398,000 tons, and for the years 1905, 1906, and 1907, 577,540 tons, showing a substantial increase.

The additional expenditure now proposed, taken in connection with past appropriations, does not appear unreasonable when compared with the commercial and navigation interests involved, and therefore the Board recommends the adoption of a modified project, providing for a navigable depth of 18 feet, as outlined within.

In compliance with section 13 of the act of March 3, 1909, the Board reports that there are no subjects not presented above having a bearing upon the improvement of navigation herein proposed which may be so coordinated with this improvement as to lessen its cost or compensate the Government for the expenditure recommended.

ECHO BAY, NEW YORK.

Report on a recent survey is printed in House Document No. 1118, Sixtieth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 3, 1908.

SIR: I have the honor to submit herewith, for transmission to Congress, reports of April 24, 1907, by Col. D. W. Lockwood, Corps of Engineers, and September 14, 1908, with map, by Col. John G. D. Knight, Corps of Engineers, on preliminary examination and survey, respectively, of Echo Bay, New York, made under authority of the river and harbor act approved March 2, 1907.

Under appropriations aggregating $51,000 Echo Bay has been improved by the United States, and work is still in progress by which varying depths of 4, 6, 7, and 9 feet at mean low water in different parts of the channel have been secured by dredging and rock excavation. The maximum draft that can now be carried to the city dock at Beauford Point is estimated at 6 feet at mean low water.

The item of law providing for this investigation directed that the same be made "with a view to obtaining a depth of 12 feet." At the time the preliminary examination was made it was apparent that further improvement of the locality to the depth of 12 feet was not worthy of being undertaken by the General Government, but it also appeared that the commercial interests involved were deserving of greater facilities than they now enjoy and that the representatives of those interests would be glad to receive any recognition in the way of increased depth that existing conditions would seem to warrant. In this view of the case and upon the recommendation of the then Chief of Engineers a survey was ordered to determine the cost of obtaining a channel of suitable width and depth of 10 feet up to Beauford Point.

In his survey report of September 14, 1908, Colonel Knight presents an estimate amounting to $22,110 as the cost of securing such 10-foot channel in Echo Bay up to Beauford Point. I concur in the opinion of the district officer and the Board of Engineers for Rivers and Harbors that the locality is worthy of further improvement to this extent.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

This bay is on the north shore of Long Island Sound, 2 miles from New York City limits. It is landlocked, except toward the southeast, and has a good anchorage. A large part of the water transportation of the town of New Rochelle is carried on through the bay.

The commerce of Echo Bay shows a steady and healthy growth in recent years, being reported as 99,000 tons in 1902, 129,400 tons in 1903, 151,200 tons in 1904, and 193,650 tons in 1905. It appears that this commerce is in need of some better facilities, and in the opinion of the Board its extent and importance are sufficient to justify a moderate expenditure for its benefit, having in mind the small amount heretofore expended at this locality. It believes that a depth of 10 feet would result in material benefits to the community, and that the cost of obtaining this increase in depth is justified.

HARBOR AT GREAT SODUS BAY, NEW YORK.

In its original condition the channel connecting this bay with Lake Ontario was wide and impracticable for vessels drawing over 8 feet.

The original project of 1829 was to narrow the entrance by constructing two converging breakwaters and to secure a channel of 12 feet depth by building two parallel piers about 450 feet apart, connecting with the ends of the breakwater, and by dredging. The present project, of 1882, is to obtain a depth of 15 feet at low water (zero of Oswego gauge) by extending the two piers a total of 1,100 feet and by dredging. After the piers had been extended 519 feet to their present lengths—west pier, 1,580 feet; east pier, 1,294 feet—the project was modified July 18, 1896, to restore and maintain the channel 150 feet wide between the piers, flaring to 250 feet in the lake, to the requisite depth of 15 feet at low water, by dredging, without further extension of the piers for the present.

The piers are 473 feet apart; east breakwater 1,651 feet long, west breakwater 2,200 feet long. During the fiscal year repairs were made to the piers to the extent necessary to prevent serious damage by seas, and at the close of the year the work of tearing out old timber superstructure on the piers and replacing it with concrete was fairly started, the work being done by hired labor.

The funds recommended to be appropriated for the fiscal year ending June 30, 1911, will be used to continue the concrete work, to make the improvement available. The project is completed except maintenance.

The amount expended to June 30, 1909, was $502,586.91, of which $94,335.11 was for maintenance.

The minimum depth June 30, 1909, was 11½ feet at low water in a channel width of 150 feet, and the usual variation of level of water surface is 3 feet.

The project is reported to have a material effect in controlling freight rates on bulk commodities, such as coal, grain, lumber, and ore.

The following is a statement of commerce at this port for the past ten years, in tons: 1899, 78,885; 1900, 84,379; 1901, 84,379; 1902, 26,726; 1903, 18,875; 1904, 30,797; 1905, 46,251; 1906, 58,905; 1907, 78,057; 1908, 73,989.

July 1, 1908, balance unexpended	$48,429.34
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	3,530.45
July 1, 1909, balance unexpended	44,898.89
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	55,000.00

GREAT SOUTH BAY, NEW YORK.

The first project, adopted September 19, 1890, provided for the improvement of the Patchogue River, a small inlet extending from Great South Bay, Long Island, to the village of Patchogue. This stream had before improvement a depth of 2 feet. The project provided for a channel about 5,000 feet long, 60 feet wide, and 6 feet deep, to be protected at its mouth against westerly storms by a jetty 1,700 feet long. Estimated cost, $40,000. On June 30, 1902, there had been expended on this work $40,000, and the project was completed.

The present project, adopted June 13, 1902, provides for dredging a channel from Fire Island Inlet, which connects Great South Bay with the ocean, to Patchogue, on Patchogue River. From the inlet to the central basin in Great South Bay the channel is to be 10 feet deep at mean low water and 200 feet wide. From the central basin to Patchogue the channel is to be 8 feet deep and 100 feet wide at mean low water. Estimated cost $66,000, and $2,000 annually for maintenance.

Up to June 30, 1909, $66,813.93 had been expended on the project, of which amount $6,993.11 was for maintenance. There was received from the sale of maps $2.92. About 90 per cent of the work contemplated under the present project has been completed, resulting in a channel 200 feet wide and 10 feet deep at mean low water in the bay, except at bars "A" and "B;" and in the completion of a channel 100 feet wide and 8 feet deep at mean low water in the river. Considerable shoaling has occurred in the latter.

Expenditures during the past fiscal year were for payment of contractor's retained percentages, examination of channel conditions, printing, advertising, etc.

A recent examination of Patchogue River has shown that to maintain the channel at a minimum of cost the present west jetty should be extended to at least the 7-foot contour in the bay; an easterly jetty should be built out from the shore to the same contour; and the channel should be redredged throughout its length to the projected depth of 8 feet below mean low water. The estimated cost of this work is $75,000, in addition to the funds now available. Further details concerning this item are given in the report of the district officer.

The available funds and the additional appropriation recommended are to be applied to maintenance, by dredging, leaving it for Congress to decide whether the jetties shall be built to aid in maintaining the project depth as proposed by the district officer.

The maximum draft that could be carried June 30, 1909, over the shoalest part of the channel from Fire Island Inlet to central basin was 8.5 feet and in Patchogue River 5 feet.

Mean range of tides, 1 foot. The head of navigation in Patchogue River is at a fixed bridge at Division street, Patchogue. The total length of navigable channel from Fire Island Inlet to Patchogue is about 17½ miles and to Belleport 22 miles.

The tonnage and value of the commerce of this locality, mainly in coal, lumber, and fish, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1898	255,200	$3,702,000	1904	257,879	$4,037,130
1899	266,800	3,808,500	1905	224,526	3,871,880
1900	274,100	3,919,000	1906	232,500	4,014,000
1901	281,300	4,025,000	1907	224,108	3,903,732
1902	257,500	4,000,000	1908	196,000	3,326,000
1903	258,500	3,995,000			

The effect of the work has been to facilitate commerce. No reduction in freight rates has been ascertained.

For details as to improvement see Patchogue River, Reports of the Chief of Engineers for 1897, page 1108; for 1901, page 1249; and for 1903, page 134. A sketch is printed in Report of the Chief of Engineers for 1903, page 876.

July 1, 1908, balance unexpended	$4,018.24
Received from sales	1.47
Amount allotted from appropriation by river and harbor act approved March 3, 1909	3,000.00
	7,019.71
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	830.72
July 1, 1909, balance unexpended	6,188.99
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	5,000.00

HEMPSTEAD HARBOR, NEW YORK.

The following report of the Board of Engineers on a recent survey is printed in Rivers and Harbors Committee Document No. 1, Sixty-first Congress, second session:

WAR DEPARTMENT,
BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., January 18, 1910.

SIR: 1. The Board has the honor to submit its report in response to the following resolution:

"*Resolved by the Committee on Rivers and Harbors of the House of Representatives*, That the Board of Engineers for Rivers and Harbors, created by the act of June thirteenth, nineteen hundred and two, be, and it is hereby, requested to reexamine the report of a preliminary examination of Hempstead Harbor, New York, printed in House Document Numbered Four hundred and sixty-three, Sixtieth Congress, first session, and report thereon."

2. The report referred to in the resolution contemplates a depth of 6 feet, and its findings are unfavorable to improvement by the General Government. It appears that the chart available at the time of the former examination showed a depth of not less than 6 feet except at one point, from the entrance to the town wharf, and it was thought that such depth existed, but later information shows that the depth is less than that at present.

3. On November 11, 1908, the Board, through a committee of its members, made a personal examination of this harbor and held a duly advertised public hearing at Roslyn, and, based on information then acquired, recommended a survey and estimate of cost, the results of which are embodied in a report by the district officer, which is forwarded herewith, as it describes in detail the physical and commercial conditions of the harbor.

4. The district officer outlines a project of improvement which provides for a channel 6 feet deep and 80 feet wide to the town wharf at Roslyn, at an estimated cost of $25,000, and for a channel of the same depth and 50 to 70 feet wide from said wharf to the head of navigation, a further distance of about 1,600 feet, at an estimated cost of $22,000, the

total estimate, therefore, being $47,000. He estimates the cost of maintenance at $3,000 annually, and with certain provisos recommends the whole improvement.

5. The amount of commerce now handled in that part of the harbor which would be affected by the desired improvement is reported to amount to about 30,000 tons annually, and it is confidently expected by those interested that this amount would be greatly increased if the harbor were improved so as to permit vessels to land at the upper wharves. It appears that this is impossible now and that the greater part of the commerce has to be lightered.

6. The results of the survey show that the depth even to the town wharf is considerably less than 6 feet and that it is practically nothing at low water at the upper wharves.

7. That the locality is handicapped by lack of suitable harbor facilities is now apparent, and the local belief that commerce would be stimulated and also increased by better facilities seems based upon facts.

8. In view of all the information now available, the Board believes this harbor worthy of improvement by the General Government, and it recommends the adoption of the project referred to in paragraph 4 above, at an estimated cost of $47,000 for first construction and $3,000 annually for maintenance, provided, however, that local interests will furnish, free of cost, a suitable dumping ground for material dredged from the channel above the town wharf.

9. The Board invites attention to the remarks and recommendations of the district officer in regard to additional public wharf facilities he deems necessary for the full use of the proposed improvement of the harbor. Section 13 of the act of March 3, 1909, calls for "such data as it will be practicable to secure regarding * * * the establishment of terminal and transfer facilities," but as it is not understood that Congress has as yet adopted the policy of making river and harbor improvements conditional upon the existence or the establishment of public wharves, the Board does not wish to recommend at this time that this locality be required to make the improvements suggested.

For the Board:

Very respectfully,

WM. T. ROSSELL,
Colonel, Corps of Engineers,
Senior Member of the Board.

The CHIEF OF ENGINEERS, U. S. ARMY,
Washington, D. C.

JAMAICA BAY, AND ROCKAWAY AND DEAD HORSE INLETS, NEW YORK.

Report on a recent survey is printed in House Document No. 1488, Sixtieth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, February 25, 1909.

SIR: I have the honor to submit herewith for transmission to Congress reports of August 3, 1907, and January 30, 1909, with map, by Col. John G. D. Knight, Corps of Engineers, on preliminary examination and survey, respectively, authorized by an item in section 3 of the river and harbor act approved March 2, 1907, as follows:

"The waters of Jamaica Bay, including entrance to said bay at Rockaway Inlet and those waters having their outlet in Dead Horse Inlet, with a view to framing a plan for their improvement and recommending the order of such improvement with the cost thereof, and to recommend the proportion of such cost to be borne by the city of New York; and the Secretary of War is hereby requested to confer and cooperate with the commissioner of docks and ferries of the city of New York, or with any other duly authorized agents, officers, or representatives of the city of New York, and with any commission of engineers appointed, or who shall hereafter be appointed, to survey or examine said bay and to recommend to the city of New York plans for the improvement of said Jamaica Bay or the lands in and about said bay."

The object of the proposed improvement contemplated by this item of the act is to provide a substantial increase in the harbor facilities for the commerce centering at New York City. Jamaica Bay is a broad, shallow body of water, and the improvement necessary to make it available for deep-draft vessels amounts practically to the construction of an artificial harbor. The portion of the work which it is proposed shall be undertaken by the General Government is the construction of the entrance channel and the main interior channel, leaving to the local authorities the work of providing secondary channels, and basins, piers, bulkheads, etc.

The cost (in round numbers) of the work to be done by the United States is estimated by the local officer at $8,610,000; for the reasons given in its report of February 23, 1909 (also herewith), the Board of Engineers for Rivers and Harbors reduces this estimate to $7,430,000. It is noted, however, that in both these estimates one item amounting to $589,500, and possibly a second amounting to $724,500, may be found to be unnecessary, in which case the total estimated cost would be reduced to about $6,000,000 and $5,000,000, respectively.

The cost of the work to be borne by the city of New York is variously estimated at $13,565,360, $47,089,375, and even as much as $70,000,000.

The order in which it is proposed that the work to be done by the General Government shall be prosecuted, if authorized, is given in detail in the reports of the local officer and of the Board of Engineers for River and Harbors. In brief, it is, first, to obtain and maintain an entrance channel 18 feet deep and 500 feet wide, this work not to be inaugurated until the Secretary of War is satisfied that the city of New York is prepared to undertake its share in the proposed improvement; second, when required by the demands of commerce, to enlarge the entrance channel to a depth of 30 feet and a width of 1,500 feet and the main interior channel to a depth of 30 feet and a width of 1,000 feet. If found by experience to be advisable, jetties are to be constructed to aid in maintaining the entrance channel.

I concur in the opinion of the district officer and the Board of Engineers for Rivers and Harbors that this locality is worthy of improvement in accordance with some progressive plan for joint prosecution by the United States and the local authorities; but it is also my opinion that the United States should not at this time be committed further than to a project for securing a depth of 18 feet, as provided in the first step of the progressive improvement recommended in the reports herewith. Any further improvement should be clearly shown to be in the interests of commerce, and the next step might properly provide for lesser depths than the 30 feet proposed by the second step in the plan now presented, and for a corresponding reduction in cost to the United States. In any event, the total ultimate cost to the United States for the improvement of this locality should not exceed the amount of the estimate submitted by the Board of Engineers for Rivers and Harbors for channels of the maximum dimensions contemplated by the reports herewith, namely, $7,430,000, plus the cost of maintaining the entrance channel.

In the course of these investigations and the preparation of his report, Colonel Knight conferred freely with the Jamaica Bay Improvement Commission, which was appointed by the mayor of New York for this purpose, such conferences being held in conformity with the terms of the act as quoted above.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

HARBOR AT LITTLE SODUS BAY, NEW YORK.

In its original condition the channel connecting this bay with Lake Ontario was about 150 feet wide and 18 inches deep.

The original project of 1854 was to protect the channel by building two parallel piers 250 feet apart across the bar to the 15-foot curve in the lake and to connect them with the shore by breakwaters. In 1867 this project was modified to provide for dredging to the depth of 12 feet. The present project, of 1882, is to obtain a depth of 15 feet at low water (zero of Oswego gauge) by extending the piers to the 15-foot curve in the lake, and by dredging. The piers had been extended 835 feet to the following lengths—west pier, 1,747 feet; east pier, 1,510 feet—when the project was modified June 29, 1898, to restore and maintain the entrance channel, 150 feet wide, to the requisite depth of 15 feet, by dredging, without further extension of the piers for the present; and this was modified by the river and harbor act of June 13, 1902, to extend the east pier 300 feet.

This extension was built—timber-crib substructure and concrete superstructure—in 1904, making the present length of the east pier 1,810 feet.

The west pier is 1,747 feet long; the east breakwater 1,680 feet long; west breakwater, 469 feet long, but entirely buried in sand and no longer maintained.

During the fiscal year the work of replacing with concrete the timber superstructure on the piers was continued slowly, the work being hampered by high water. Three hundred and twenty-six linear feet was completed. At the close of the year the U. S. dredge *Frontenac* was employed in restoring project depth in the channel between the piers. The project is completed except maintenance.

The appropriation recommended will be applied to continuing the work outlined above to make the improvement available.

The amount expended to June 30, 1909, was $425,740.68, of which $124,377.88 was for maintenance.

The minimum depth over the shoalest part of the locality under improvement, June 30, 1909, was 13 feet at low water in a channel width of 100 feet, and the usual variation of level of water surface is 3 feet.

The project is reported to have a material effect in controlling freight rates on bulk commodities, such as coal, grain, lumber, and ore.

The following is a statement of commerce at this port for ten years, in tons: 1899, 81,969; 1900, 59,511; 1901, 135,118; 1902, 52,543; 1903, 120,692; 1904, 137,258; 1905, 105,298; 1906, 103,991; 1907, 108,804; 1908, 153,474.

Work proposed for the ensuing year, necessary to make the improvement available, consists in maintenance of channels and piers.

For more extended information and map, see Annual Report of the Chief of Engineers for 1881, page 2443 et seq.

July 1, 1908, balance unexpended	$61,055.06
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	17,512.01
July 1, 1909, balance unexpended	43,543.05
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	35,000.00

NEW YORK HARBOR, NEW YORK.

There are at present two channels of approach to New York Harbor, the Main Ship-Bayside-Gedney channel and the new Ambrose channel.

Main Ship-Bayside-Gedney channel.—Before improvement by the United States this channel carried a depth of 23.7 feet across the outer bar at mean low water, and about the same depth across three other shoals between the bar and deep water in the harbor. A large proportion of the commerce of the port, carried in vessels of greater draft, could cross these shoals only at or near high water.

The project for the improvement of the outer portion of this channel, known as Gedney channel, was approved by the Secretary of War, December, 1884, under the provision of the river and harbor act of 1884, and in 1886 was extended to cover the whole of the main entrance. It provided for dredging a channel 30 feet deep at mean low water, and 1,000 feet wide, between the sea and deep water at

the Narrows. The estimated cost was $1,490,000 for dredging 4,300,000 cubic yards. The work was substantially completed in October 1891, by the dredging of 4,875,079 cubic yards.

The maintenance of this route has been carried on under a project approved November 15, 1892, under the provision of river and harbor act of July 13, 1892. The total expended in maintenances for the period of seventeen years since completion of project in 1892 is $687,897.28. The cost has been increasing from year to year and the present estimated amount required for maintaining the channel to full width and depth is $100,000 per year. It would not have been below this for several years if the channel had been kept its full width of 1,000 feet. The amount expended in original excavation was $1,518,024.52.

These expenditures have resulted in maintaining a channel 30 feet deep at mean low water for a width of 1,000 feet or over, except on the Main Ship channel where the width has varied from 600 to 800 feet.

The work of the fiscal year ending June 30, 1909, has consisted in the removal of 73,681 cubic yards of mud and sand from the west side of the Main Ship channel where the accretions are continuous and greatest, due to the set of the tidal current across the course of the channel. Bayside and Gedney portions of the channel are farther seaward and more nearly true with the tide currents, and require comparatively little dredging to maintain the full width and depth.

The length of that part of New York Harbor included in the limits of the project (from Atlantic Ocean to the Battery, New York City) is 22½ miles. The dredging has extended over about 8 miles of this route. The mean rise of tide is 4½ feet.

Ambrose channel.—Ambrose channel (formerly known as East channel) had an original available depth of 16 feet at mean low water and was used only by towboats, scows, and very light-draft vessels. By the terms of the river and harbor act of 1899 a project was adopted for making an entrance to New York Harbor by this channel, to be 2,000 feet wide and 40 feet deep at mean low water. It involved an estimated excavation of about 42,500,000 cubic yards of material for a length of 7 miles of channel. The work was authorized to be done under a continuing contract at a cost not exceeding $4,000,000. Under the act of March 3, 1903, two United States dredges were built to supplement the contract work, which was far behind the required rates. In October, 1906, the contractor abandoned the work, and the river and harbor act of 1907 authorized the building of two more United States dredges, at the same time changing the authorized limit of expenditure to $5,148,510. The sum of $324,510 is yet to be appropriated under the contract authorization.

To July 1, 1909, $4,197,932.47 has been expended in building four dredges and in excavating 42,911,791 cubic yards of sand, mud, and stones.

During the fiscal year ending June 30, 1909, four United States dredges were continuously engaged upon this work, excavating 10,786,638 cubic yards of sand and mud; and under contract for removing old stone dumps from the channel, 6,889 cubic yards of stones mixed with sand were taken out.

Ambrose channel has now a depth of 40 feet at mean low water, with width of about 1,000 feet. It is easily navigable at mean low

tide for ships of 37 feet draft going at moderate speed, and has a maximum high-water capacity of 44 feet. The project is regarded as about three-quarters completed.

This channel was first buoyed for navigation in September, 1907, and regulations were issued by the Secretary of War, under authority of law, restricting its use to daylight navigation by ships of 29 feet draft or over, or of 600 feet length or over. As the improvements progressed it became practicable to remove most of this restriction, and under authority of act of Congress of March 3, 1909, regulations were issued permitting the use of the channel by day or night by all steamships or steamers not having tows, regardless of size. This was promptly made use of, and now the channel is used by practically all of the trans-Atlantic lines and many of the others.

GENERAL IMPROVEMENT.

June 30, 1909, amount expended during fiscal year, for maintenance of improvement		$59,586.77
July 1, 1909, balance unexpended		98,602.72
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		150,000.00

AMBROSE CHANNEL.

July 1, 1908, balance unexpended		793,653.23
Amount appropriated by sundry civil act approved March 4, 1909		627,000.00
Received from sale of property and maps		52.70
		1,420,705.93
June 30, 1909, amount expended during fiscal year:		
For construction of dredges	$345,958.34	
For works of improvement	480,428.32	
Deposited to credit of Delaware River appropriation	11,163.07	
Transfer settlements	3.68	
		837,553.41
July 1, 1909, balance unexpended		583,152.52
July 1, 1909, outstanding liabilities		34,325.31
July 1, 1909, balance available		548,827.21
Amount (estimated) required for completion of existing project		324,510.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, exclusive of the balance unexpended July 1, 1909:		
For works of improvement	$324,510.00	
For maintenance of improvement	195,490.00	
		520,000.00

OGDENSBURG HARBOR, NEW YORK.

Following is the report of the Board of Engineers on a recent survey, concurred in by the Chief of Engineers, and printed in House Document No. 920, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., March 28, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

In its report of April 29, 1907, on the preliminary examination of this locality the Board expressed the opinion that the commerce involved is sufficient to justify the expense of increased navigation facilities if these could be provided at reasonable

cost, and recommended that an estimate be submitted for increasing the depth of this harbor to 19 feet. In conformity with the above the district officer submitted an estimate of cost amounting to $130,000 for deepening to 19 feet the upper entrance channel, the two lower entrance channels, and the channel along the city front. No estimate was submitted for removing the middle ground mentioned in the act, as at the time of the preliminary examination available information did not indicate the necessity for this work.

Following the submission of the estimate mentioned above, it was deemed advisable to afford interested parties an opportunity to present statements and arguments in behalf of the removal of the middle ground, and on February 17, 1908, a committee of citizens of Ogdensburg appeared before the Board in relation to this matter. From the information furnished by this committee, it appears that in time of high winds and on dark nights much difficulty has been experienced in entering and departing from this harbor, and a number of vessels have gone aground and others have refused to enter on account of the unfavorable conditions. These facts led the Board to believe that the middle ground should be removed in whole or in part, if the improvement could be accomplished at reasonable cost, and it therefore recommended that estimates of cost be prepared. These estimates are contained in the supplemental report of the district officer accompanying.

It is estimated that the middle ground can be entirely removed to a depth of 19 feet below the zero of the gauge at Ogdensburg at a cost of $57,970, and that it can be partially removed by an additional cut 200 feet wide on the east and west sides and 100 feet wide on the south side at a cost of $24,310, making the entire cost of the improvement of this harbor to a depth of 19 feet $187,970, if the middle ground is wholly removed, and $154,310 if it is partially removed, as specified above.

Considering the large commerce of this port, now exceeding 1,000,000 tons annually, the comparatively small amount of government funds heretofore expended at this locality, and the probable benefits that will result from its further improvement, the Board believes that it is advisable for the United States to deepen to 19 feet the several channels of the harbor in the manner proposed by the district officer, and to remove wholly the middle ground between the two lower entrance channels, at a total estimated cost of $187,970, and it recommends that the project for the improvement of Ogdensburg Harbor be modified accordingly.

HARBOR AT OSWEGO, NEW YORK.

This harbor comprises the lower part of Oswego River, a cove at its mouth, protected by a breakwater now known as the "inner breakwater," and an outer harbor formed by an outer breakwater. In its original condition the harbor in the Oswego River was navigable by vessels of light draft only, and the cove had no protedtion against the lake seas.

The original project of 1827 (completed in 1829) was to build across the cove a breakwater of timber cribs filled with stone. Between 1830 and 1838 a superstructure of masonry was built on 500 feet of this breakwater. Between 1866 and 1869, $41,000 was expended in dredging the harbor to the depth of 12 feet at extreme low water. Between 1868 and 1870 a light-house pier was built, extending north 437 feet from the channel end of the breakwater. In 1871 the project for an outer harbor formed by an outer breakwater was adopted, and in 1881 an outer breakwater was completed having a lake face 4,870 feet long, a westerly shore return 916 feet long, and an easterly return 246 feet long. In 1881 a project was adopted to build an east breakwater, 248 feet of which was constructed in 1881 and removed in 1889. In 1885 and 1889 two spurs to the outer breakwater, 100 and 150 feet long, respectively, were built.

In the acts of March 3, 1893, and August 18, 1894, special provisions were made for extending the deep-water area of the harbor in the mouth of the Oswego River by the removal of rock.

The present project was adopted June 3, 1896, based on a special report printed in the Annual Report of the Chief of Engineers for 1895, page 3213, et seq, and as subsequently modified is, first, to build an east breakwater 1,435 feet long, at an estimated cost of $197,000 (acts of March 3, 1895, and June 3, 1896); second, to narrow the breach made in the outer breakwater in 1884 from 175 feet to about 75 feet, at an estimated cost of $18,500; third, to widen and deepen the inner harbor in the mouth of the Oswego River and to extend the deep-water area farther upstream by rock excavation.

There are 5,907 feet of outer breakwater and 1,993 feet of inner breakwater and light-house pier, forming an outer harbor containing 140 acres and an inner harbor containing 9.35 acres (including the Oswego River). The areas having a controlling depth of 14.5 feet at low water are 40 acres in the outer harbor and 4½ acres in the inner harbor.

Under maintenance there is required: The maintenance of the outer breakwater and inner breakwater and light-house pier, the maintenance of a depth of 15.7 feet at low water in the entrance channel and in the outer harbor, and the maintenance of a depth of 15 feet at low water in the cove behind the inner breakwater and in the harbor in the mouth of Oswego River.

The plane of reference is low water (zero of Oswego gauge).

The outer breakwater is difficult and costly to maintain.

The river and harbor act of March 3, 1905, made an appropriation for continuing repairs with timber under the method printed as plan "B" on page 3368, Annual Report of the Chief of Engineers for 1904. Under this appropriation extensive repairs were made with timber to the outer breakwater during 1905–6, and, owing to extensive damage by storms, were continued during the past fiscal year to preserve parts damaged from complete destruction.

The river and harbor act of March 2, 1907, made an appropriation of $100,000 and authorized contracts to the extent of $100,000 additional, all of which has been appropriated, for reconstruction under plan "A," printed on page 3368 of the Annual Report of the Chief of Engineers for 1904, which contemplates a stone superstructure and sea slope, at an estimated cost of $900,000. This work was begun during the fiscal year 1908.

The amount expended for all work to June 30, 1909, was $2,211,564.70. It is impracticable to separate the cost of construction and maintenance. The project is completed except for maintenance, which is being prosecuted under a plan specifically adopted by Congress.

The funds recommended to be appropriated for the fiscal year ending June 30, 1911, will be used to continue the reconstruction of the outer breakwater to make the improvements available.

June 30, 1909, the minimum depth at low water over the shoalest part of the locality under improvement was 14 feet.

The usual variation of level of water surface is 3 feet.

The project is reported to have a material effect in controlling freight rates on bulk commodities, such as coal, grain, lumber, and ore.

The following is a statement of the commerce of this harbor for the past ten years, in tons: 1899, 716,753; 1900, 575,160; 1901, 565,052; 1902, 334,009; 1903, 733,734; 1904, 712,481; 1905, 724,502; 1906, 615,840; 1907, 728,090; 1908, 724,187.

Work proposed for the ensuing fiscal year, necessary to make the improvement available and extend its benefits, consists in dredging on shoals as may be required in the outer harbor and entrance channel, continuing the reconstruction of the outer breakwater under plan "A," and repairs on timber structures when required. The appropriation recommended will be applied to this work.

July 1, 1908, balance unexpended	$82,109.89
Amount appropriated by sundry civil act approved March 4, 1909	100,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	40,000.00
Sales	11.00
	222,120.89
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	66,777.94
July 1, 1909, balance unexpended	155,342.95
July 1, 1909, amount covered by uncompleted contracts	38,534.51
Amount (estimated) required for completion of existing project	700,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	200,000.00

PORT CHESTER HARBOR, NEW YORK.

Report on a recent survey is printed in House Document No. 1165, Sixtieth Congress, second session. Following is the letter of the Chief of Engineers submitting the same.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 5, 1908.

SIR: I have the honor to submit herewith for transmission to Congress reports of August 20, 1907, and October 31, 1908 (with map), by Col. John G. D. Knight, Corps of Engineers, on preliminary examination and survey, respectively, authorized by the river and harbor act approved March 2, 1907, of Port Chester Harbor, New York, with a view to obtaining a depth of 15 feet with corresponding width.

Port Chester Harbor has been under improvement since 1872. The present project provides for a channel 12 feet deep at mean low water and 70 feet wide from deep water in the bay up to the town wharf and thence 9 feet deep and 60 feet wide to the steamboat wharf.

In the course of the present investigation it became apparent that a channel depth of 15 feet with corresponding width, as specified in the act referred to, would be prohibitive in cost; but it also became known that the general demand was as much for increased width as increased depth.

With a view to furnishing such additional facilities as would be justified by the commercial interests involved, the local officer presents in his survey report a project briefly described as follows and shown on the accompanying chart:

A depth of 12 feet with width of 150 feet is carried to the southerly point of Fox Island; thence a depth of 10 feet, with width of 100 feet, is carried to just below the steamboat dock; above the dock and to 900 feet below the fixed bridge, the 10-foot depth is maintained, but the width, which includes a turning basin off the steamboat dock, varies from 100 to 340 feet; for 800 feet above this last length a 3-foot depth is proposed, with width varying from 175 feet to 100 feet. The cost of this work is estimated at $188,000, with $2,500 annually for maintenance after completion.

I concur in the opinion of the district officer and the Board of Engineers for Rivers and Harbors that Port Chester Harbor is worthy of further improvement to the extent above indicated.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

The commerce of this harbor, mainly in coal, iron ore, building materials, manufactured goods, and farm produce, is reported as 265,000 tons for the year 1906; for the year 1898 it was 140,000 tons.

HARBORS AT PORT JEFFERSON, MATTITUCK, HUNTINGTON, AND FLUSHING BAY, NEW YORK.

(*a*) *Port Jefferson Harbor.*—This is a large and deep inland bay, situated on the north shore of Long Island and connected with Long Island Sound by a narrow entrance.

Before improvement the channel depth outside the entrance was but 4 feet at mean low water, whereas the depth in the harbor was 12 feet and more, at low tide, up to within 300 feet of the wharves of Port Jefferson village.

The first project for improvement was adopted in 1871 and completed in 1883, at a total cost of $79,000. Two jetties were built to shelter the inlet channel, one east of the inlet, 1,390 feet long, and one west, 940 feet long, both of scant cross section. A channel 8 feet deep at mean low water and 100 feet wide was dredged through the inlet and shoal outside.

The existing project for improvement, adopted September 19, 1890, and modified August 18, 1894, provides for dredging a channel through the harbor entrance 12 feet deep and 200 feet wide, to be protected by extending and enlarging the previously built jetties. Estimated cost, $145,000.

Up to June 30, 1909, $97,156.35 had been expended on the present project; of this amount $5,929.64 was for maintenance.

About 67 per cent of the work proposed under the present project has been completed, and has resulted in making a channel 12 feet deep at mean low water and 200 feet wide, and in completing the east jetty to its full projected section for a distance of 1,550 feet, except at the shore end, where it is covered by sand. The west jetty is 940 feet long, with scant cross section. No work has been done on this jetty under the present project. The dredged channel has maintained its projected depth during the past year.

The available funds and additional appropriation recommended are to be applied to continuing the improvement and to dredging for maintenance if found necessary.

The maximum draft that could be carried over the shoalest part of the channel June 30, 1909, is probably 12 feet at mean low water. Mean range of tides at entrance, 7 feet; at Port Jefferson wharves, 6.2 feet. The total length of navigable channel from Long Island Sound to Port Jefferson wharves is about 2½ miles. The harbor is about 2 miles long and three-fourths of a mile wide.

The tonnage and value of the commerce of this harbor, mainly in coal, building materials, farm produce, fish, and general merchandise, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1898	24,940	$360,200	1905	19,650(?)	$565,700(?)
1899	42,130	2,145,940	1906	118,705	2,544,900
1903	46,670	776,000	1907	95,455	1,066,665
1904	8,832(?)	90,424(?)	1908	127,230	1,536,000

Freight rates have probably been reduced as a result of this improvement.

For detailed report see Report of the Chief of Engineers for 1900, page 1393. A sketch of Port Jefferson Harbor is printed in Report of the Chief of Engineers for 1900, page 866.

(*b*) *Mattituck Harbor.*—This harbor is a tidal inlet extending in a southerly direction from Long Island Sound to the village of Mattituck, Long Island. One mile above the mouth a tide milldam with gates and fixed bridge has been built across the stream. Before improvement the entrance was obstructed by a shifting sand bar, rising to within from 1 to 2 feet below the mean low-water plane; thence up to the milldam the depth was from 2 to 7 feet at low tide; and above the latter 6 feet at high tide.

The project adopted by the act of June 3, 1896, provides for a channel 7 feet deep at mean low water from the entrance to the dam and 7 feet deep at mean high water above the dam to the village, the width to be 80 feet, except near the mouth, where it is increased to 100 feet; the entrance channel to be protected by two parallel jetties, 400 feet apart, extending out to the 9-foot curve. Estimated cost, $83,000.

Up to June 30, 1909, $56,258.82 had been expended on the project; of this amount, $3,700 was for maintenance. There was received from sales of maps $4.35.

About 68 per cent of the work proposed under the project has been completed, resulting in building the west jetty to full projected section for a length of 680 feet, extending out to the 10-foot contour; the east jetty to full projected section for a length of 775 feet, extending out to the 7-foot contour; and in dredging a channel at the entrance 7 feet deep at mean low water, 100 feet wide, and about 1,400 feet long, thence a distance of about 400 feet, the same depth and 80 feet wide; and thence a distance of about 2,000 feet, the same depth and 60 feet wide.

The harbor is now used as an anchorage by a number of oyster vessels, which have recently commenced operations in this vicinity.

A recent survey has shown the necessity of extending both jetties into deeper water and of connecting the inner end of the west jetty with the shore above high water. It is also shown that the volume of dredging required to complete the channel to the milldam is approximately 63,000 cubic yards in excess of the amount estimated in 1891, when the project was submitted. To complete the project as far as the dam, located about 1¼ miles below Mattituck. an expenditure of $53,200 will be required in addition to the funds now available.

It is recommended that the improvement be extended beyond the milldam only after the local authorities have removed the dam and replaced the fixed bridge by a bridge with draw spans.

The available funds and additional appropriation recommended are to be expended in continuing the improvement and in maintenance.

The maximum draft that could be carried June 30, 1909, over the shoalest part of the unimproved channel below the milldam at mean low water is about 1½ feet; above the milldam the least depth is about 6 feet at mean high water. The head of navigation is at the village of Mattituck. The total length of navigable channel from Long Island Sound to the milldam is about 1 mile; thence to Mattituck about 1¼ miles. The mean range of tides outside the entrance is 4.8 feet, and below the milldam, which before dredging in the entrance was 2.2 feet, is now 4.4 feet.

The commerce consists principally of coal, building materials, fruits, farm produce, and general merchandise, and was reported in

1904 as amounting to 56,602 tons, valued at $2,041,766. The commerce by water during the calendar year 1908, mostly in fish and farm produce, amounted to 1,100 tons, valued at $22,000. As a result of the improvement several thousand acres of oyster beds have been recently established in the vicinity, the boats used in the industry finding a safe harbor in the river.

No change in freight rates has yet resulted, the work not being sufficiently advanced.

(*c*) *Huntington Harbor.*—This harbor is a narrow tidal estuary extending inland from Huntington Bay, Long Island, in a southerly direction for a distance of about 2 miles.

Before improvement it had a natural available depth of nearly 8 feet, mean low water, for a stretch of 1¼ miles from the entrance southward, thence gradually decreasing to zero toward the head of the harbor.

In 1872 the first project was adopted, under which in 1873 a shoal at the harbor entrance was removed and a channel 2,200 feet long, 130 to 150 feet wide, and 8 feet deep at mean low water was dredged up to the town landings at a total cost of $22,500. In 1884 this channel had completely filled up.

The present project, adopted September 19, 1890, provides for dredging and maintaining a channel 8 feet deep at mean low water and 100 feet wide up to the upper wharves, to be protected by piling, if necessary. Estimated cost, $32,000.

Up to June 30, 1908, $38,000 had been expended on this project; of this amount $8,510.94 was for maintenance.

The present project is completed, except as to the dredging or pile construction necessary to maintain the channel. For purposes of maintenance the channel has been dredged 200 feet wide in lieu of pile protection. The dredged channel has deteriorated to a considerable extent.

The appropriation recommended is to be applied to maintenance.

The maximum draft that could be carried June 30, 1908, over the shoalest part of the improved channel is estimated at about 8 feet at mean low water in about mid-channel; less depth than is reported to exist over a bar at the harbor entrance.

Mean range of tide, 7.2 feet. The head of navigation is at a causeway about one-third of a mile above Town dock. The total length of navigable channel from Huntington Bay to the causeway is about 2 miles.

The tonnage and value of the commerce of this harbor, mainly in coal, farm produce, building material, and miscellaneous merchandise, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1897	23,584	$473,109	1904	94,950	$2,818,250
1899	46,500	605,000	1906	105,212	2,774,850
1900	45,600	768,000	1907	96,196	1,901,061
1901	52,000	875,800	1908	38,316	413,218
1903	66,000	1,086,000			

This improvement has resulted in a material reduction in freight rates.

For detailed description see Report of the Chief of Engineers for 1897, page 1100. A sketch of the upper part of the harbor is printed in the Annual Report for 1904, page 1023.

(*d*) *Flushing Bay.*—Flushing Bay is on the north shore of Long Island, about 14 miles by water from the Battery, New York City. The bay is about 1 mile wide and 2 miles long, the depth in the original channel being not much greater than elsewhere in the bay. Before improvement the controlling depth up to Flushing was 3.9 feet at mean low water.

The existing project adopted March 3, 1879, and modified September 19, 1888, and June 9, 1891, provides for building a dike 4,663 feet long on the west side of the channel to protect it from filling and for making and maintaining a channel 6 feet deep at mean low water up to the lower bridge at Flushing. Estimated cost, $173,500.

Up to June 30, 1909, $160,761.19 had been expended on the project. During progress of work it has been repeatedly necessary to redredge some parts of the channel, so that it is not possible to state exactly what part of above sum was used for maintenance. The expenditure to June 30, 1909, for maintenance is estimated at $13,132.24.

The project has been completed except as to removing a small shoal below Broadway Bridge, and to making such slight changes in the outer end of the dike as to make it less of an obstruction to navigation. There is now a channel having a least depth of 6 feet at mean low water, and 200 feet wide up to Broadway Bridge, except as to the above-mentioned shoals. Thence to Main Street Bridge of the Long Island Railroad Company the channel is 100 feet wide and not less than 6 feet deep at mean low water. The whole of the dike is in bad condition, and all of the outer end, 1,606 feet long, with the exception of a few scattering piles and stones, has been carried away by storms and ice. Dike construction was discontinued in 1891.

The available funds are to be applied to making such slight changes in the dike as may be necessary to make it less of an obstruction to navigation, and to completing the improvement, and the additional appropriation recommended is to be applied to maintenance.

The maximum draft that could be carried June 30, 1909, from East River to just beyond the Main Street Railroad Bridge at mean low water is estimated at 6 feet. Mean range of tides, 7.1 feet. The head of navigation is 1 mile above Strong's causeway. The total length of the navigable channel is about 5½ miles.

The tonnage and value of the commerce of Flushing Bay, mainly in coal, building materials, dyewoods, and miscellaneous merchandise, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1897	163,395	$1,449,438	1904	142,996	$2,599,488
1899	158,755	1,534,937	1905	142,274	2,656,650
1901	200,473	4,196,406	1906	273,312	3,937,444
1902	186,000	1,613,100	1907	232,911	2,537,825
1903	110,100	960,750	1908	126,455	1,774,900

This work has facilitated transportation, but no appreciable effect on freight rates has been ascertained.

CONSOLIDATED.

July 1, 1908, balance unexpended		$60,366.68
Received from sales		1.50
Amount allotted from appropriation by river and harbor act approved March 3, 1909		6,000.00
		66,368.18
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$30,960.76	
For maintenance of improvement	4,080.54	
		35,041.30
July 1, 1909, balance unexpended		31,326.88
July 1, 1909, outstanding liabilities		4,726.07
July 1, 1909, balance available		26,600.81
July 1, 1909, amount covered by uncompleted contracts		12,173.90
Amount (estimated) required for completion of existing project		167,573.29
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		46,500.00

HARBORS AT RONDOUT AND PEEKSKILL, NEW YORK.

(*a*) *Rondout Harbor.*—This harbor is situated at the mouth of Rondout Creek, on the west shore of the Hudson River, 90 miles above New York City. The creek, which is navigable to Eddyville, 3 miles from its mouth, was the most easterly section of the Delaware and Hudson Canal until that waterway was abandoned several years ago. Before improvement was begun under the adopted project a depth of 7 feet at mean low water had been obtained as a result of work done by private parties.

The original project, adopted June 10, 1872, provided for a channel 14 feet deep at mean low water and 100 feet wide, at an estimated cost of $172,500, and was completed in 1880 at a total cost of $90,000. Since then the expenditures have been for maintenance.

Up to June 30, 1909, $140,928.63 had been expended on the project. Of this amount $50,928.63 was for maintenance.

The above expenditure has resulted in making a channel 12½ feet deep at mean low water and not less than 100 feet wide.

The available funds and additional appropriation recommended are to be applied to maintenance.

The maximum draft that could be carried through the channel June 30, 1909, was 13 feet at mean low water, with a least width of channel of about 75 feet. The mean rise and fall of tides is 4 feet. The head of navigation is at Eddyville. The total length of navigable channel is about 3 miles.

The tonnage and value of the commerce of this harbor, mainly in general merchandise, building materials, fuel, and ice, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1904	1,469,000	$41,065,000	1907	1,255,000	$5,025,000
1905	1,325,000	46,112,500	1908	438,000	2,075,000
1906	998,524	5,640,900			

The effect of the improvement has probably been to keep the freight rates down during the season of navigation.

Detailed description of this improvement is printed in Reports of the Chief of Engineers for 1880, page 494, and for 1895, page 913. A sketch of the harbor is printed in Report of the Chief of Engineers for 1903, page 1884.

(*b*) *Peekskill Harbor.*—This harbor is an indentation on the eastern shore of the Hudson River, about 46 miles above New York City, about five-eighths of a mile long and 1¼ miles wide, having before improvement a controlling depth of about 5 feet at mean low water, except near the wharves in Peekskill, where it was about 6 feet.

The original project for improvement, adopted June 3, 1896, provided for a dredged channel 10 feet deep at mean low water and 100 feet wide from deep water in the Hudson River north of the village to deep water south of it, following generally the contour of the shore, at an estimated cost of $50,000. The project was completed in 1899 at a cost of $19,400.

Up to June 30, 1909, $28,222.26 had been expended on the project; of this amount $8,822.26 was for maintenance.

Disbursements during the year were mainly in part payment of office expenses.

The channel was restored to its projected depth and width in 1907. It is probable some shoaling has occurred since then.

The available balance and the additional appropriation recommended are to be applied to maintenance.

The maximum draft that could be carried through the channel June 30, 1909, at mean low water is probably less than 10 feet. Mean range of tides about 3 feet. The total length of channel is 1¼ miles.

The tonnage and value of the commerce of this harbor, mainly in general merchandise, building material, and fuel, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1904	81,265	$3,751,985	1907	107,963	$733,766
1905	74,546	1,134,748	1908 [a]	226,533	4,984,046
1906	88,500	659,864			

[a] Increase mainly due to the receipt of more complete statistics for 1908 than for previous years.

A slight reduction in freight rates has been reported.

CONSOLIDATED.

July 1, 1908, balance unexpended	$11,124.21
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	8,475.10
July 1, 1909, balance unexpended	2,649.11
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	6,000.00

SAUGERTIES HARBOR, NEW YORK.

Saugerties Harbor is the name applied to the mouth of Esopus Creek, which empties into the Hudson River from the west, about 100 miles above New York City, which creek is navigable at high water for a distance of about 6,000 feet from deep water in the Hudson River. Above the steamboat landing, which is a distance of about 4,500 feet from deep water, there is little traffic. The original depth over the bar was 3 feet at mean low water, which had been increased to 7 feet by dredging done by the State of New York in 1885–86.

The original project, which contemplated securing a permanent channel 7 feet deep at mean low water and 100 feet wide, at an estimated cost of $52,000, was adopted in 1884, modified in 1887, and completed in 1892, with an expenditure of $42,000. To June 30, 1902, $15,000 had been expended for maintenance.

The existing project, adopted June 13, 1902, provides for a channel 12 feet deep at mean low water and 200 feet wide from deep water in the Hudson River to the steamboat landing, at an estimated cost of $44,685, with an estimated annual expenditure of $2,500 for maintenance.

Up to June 30, 1909, $44,137.98 had been expended on the present project; of this amount $19,064.99 was for maintenance. There was received from the sale of maps $1.10.

About 56 per cent of the work proposed under the present project has been completed, resulting in widening and straightening the navigable channel of 12 feet depth where Barclays Point and Powderhouse reefs have been removed, and in making a fair channel from the mouth of the harbor to the steamboat landing.

The expenditure for maintenance is mainly due to restoring the channel above the reef—where, owing to the breaking of the dam a short distance above the head of navigation in the summer of 1902 and the consequent release of a large quantity of mud and silt retained by it, the channel had been reduced in width and depth so as to be practically closed to navigation by large boats—and to the relief to navigation along the wharves on the north side of the channel, where extensive shoaling had taken place, apparently as the result of the removal of the rock off Barclays Point.

The available funds and additional appropriation recommended are to be applied to continuing the improvement, and to maintenance.

The maximum draft at mean low water that could be carried June 30, 1909, is estimated at 10½ feet for a minimum width of 50 feet. The mean rise and fall of tides is about 4 feet. The head of navigation is at a point about 1,600 feet below the dam. The total length of navigable channel is about 1¼ miles.

The tonnage and the value of the commerce of this harbor, mainly in building materials, manufactures, fuel, and general merchandise, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1901	67,473	.....	1905	81,600	$1,598,000
1902	66,500	.....	1906	83,300	1,606,200
1903	112,677	.....	1907	95,400	1,873,000
1904	113,200	$18,832,195(?)	1908	114,000	2,070,500

The effect of the improvement, according to the best information available, is to reduce freight rates during the season of navigation.

July 1, 1908, balance unexpended	$16,141.87
June 30, 1909, amount expended during fiscal year, for works of improvement	12,278.75
July 1, 1909, balance unexpended	3,863.12
Amount (estimated) required for completion of existing project	15,749.99
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	15,000.00

TARRYTOWN HARBOR, NEW YORK.

This harbor is located on the east shore of Hudson River, about 28 miles above New York City, where the river is several miles wide. The channel is bordered on both sides by extensive flats, that on the east side measuring about three-eighths of a mile from the main wharf to the 12-foot depth in the river. The general depth in the harbor is about 4½ feet at mean low water.

Before improvement two channels of about 6 feet depth led up to main wharf.

The original project for improvement, adopted March 3, 1905, provides for a channel along the wharf front of the harbor and connecting it north and south with deep water in Hudson River, to be 12 feet deep at mean low water, and 150 feet wide along the wharf front; and 100 feet wide in the northerly and southerly connections with the Hudson River. Estimated cost, $26,000, increased in 1907 to $35,491.68, and $1,000 or $2,000 biennially for maintenance.

Up to June 30, 1909, $23,226.27 had been expended on this project, all in improvement. About 65 per cent of the work proposed under the project has been completed, resulting in a channel 100 feet wide and 12 feet deep, at mean low water, in the southern arm; 100 feet wide and 10 to 12 feet deep along the wharf front except opposite Husted's dock, where it is only 60 feet wide; 60 feet wide and 12 feet deep for 350 feet in length of the eastern end of the northern arm; and 60 feet wide but of less than 12 feet depth for a farther distance of 100 feet in the northern arm. It is probable that the dredged areas have shoaled to an appreciable extent.

The available funds and additional appropriation recommended are to be applied to continuing the improvement and to maintenance.

The maximum draft that could be carried in the dredged channel June 30, 1909, at mean low water, from deep water in the Hudson River south of Tarrytown to Husted's wharf in Tarrytown, is estimated at 12 feet, and from deep water in the Hudson River north of Tarrytown to the same wharf at 6 feet. Mean range of tides is about 3½ feet. The total length of projected channel is about 1⅛ miles.

The tonnage and value of the commerce of this harbor, mainly in general merchandise, coal, and building materials, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1905	71,201	$1,830,092	1907	86,076	$3,641,915
1906	79,714	384,979(?)	1908	71,325	3,648,856

A slight reduction in freight rates has been reported as resulting from the improvement.

July 1, 1908, balance unexpended	$3,985.88
June 30, 1909, amount expended during fiscal year for works of improvement	1,212.15
July 1, 1909, balance unexpended	2,773.73
Amount (estimated) required for completion of existing project	9,491.68
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	12,500.00

BRONX RIVER AND EAST CHESTER CREEK, NEW YORK.

(*a*) *Bronx River.*—This stream empties into a shallow bay three-fourths of a mile long and seven-eighths of a mile wide, having a navigable channel with low-water depth of 3 feet, and which opens into the East River north of Hunts Point. The navigable part extends from its mouth to West Farms, a length of about 2¼ miles. At this point it is crossed by a dam. The natural depth at the mouth was 4 feet at mean low water, and decreased ascending the stream to less than 1 foot at the head of navigation.

The project for improvement, adopted by the act of June 3, 1896, provides for making a channel 4 feet deep at mean low water and 100 feet wide from the mouth to Barlow street (now Falconer street); thence to Dongan street (now Garrison avenue) 60 feet wide, and thence to the head of navigation 50 feet wide, the work to be done by dredging and rock removal. Estimated cost, $85,985.

Up to June 30, 1909, $67,437.03 had been expended on the project for improvement. There was received from sales of maps $0.65.

About 80 per cent of the work proposed under the present project has been completed and has resulted in a channel from the mouth to the turn east of the gas works with depths of from 3 to 6 feet at mean low water and with a diminishing width of from 100 to 50 feet, except at Westchester avenue where slightly reduced by a ledge of rock. Above this point the channel remains as previously reported. As shown by a recent survey, the dredged channel has deteriorated to a considerable extent.

The available funds and additional appropriation recommended are to be applied to continuing the improvement and to maintenance.

The maximum draft that could be carried June 30, 1909, over the shoalest part of the channel at mean low water from the mouth to the turn east of the gas works is about 2½ feet; above this point, 1 foot. Mean range of tide is 6.6 feet at mouth and 6 feet at West Farms. The head of navigation is at a dam just beyond the dye works. The total length of navigable channel is about 3 miles.

The tonnage and value of the commerce of this river, mainly in coal, cotton goods, drugs for dyeing purposes, ice, and building materials, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1897	139,310	$526,025	1905	181,093	$820,482
1899	171,300	1,985,700	1906	341,538	1,720,097
1902	153,137	500,000	1907	382,957	1,807,317
1903	77,710	536,400	1908	401,433	2,017,500
1904	42,286	196,642			

The river has an extensive and growing commerce as shown above. This commerce is mainly carried on barges of from 20 to 35 feet width, towed by tugs. Just complaint is made of the interruptions and delays to traffic owing to the impossibility of tows passing each other in the narrow channel and at points of even passing a barge moored to a wharf. Due to the slight depth found, all movement of vessels must be made at high-water stages.

(*b*) *East Chester Creek.*—This is a small tidal stream emptying into East Chester Bay. It was originally navigable at high tide for vessels drawing 7 feet as far as Lockwoods, a distance of 2¼ miles.

The project for improvement, adopted March 3, 1873, provided for a channel 100 feet wide and 9 feet deep, mean high water, from deep water in East Chester Bay to a point 3,000 feet above Lockwoods. Estimated cost, $136,500; subsequently reduced to $124,000, as modified in 1891.

Up to June 30, 1909, $115,500 had been expended on the project; of this amount $25,408.78 was for maintenance. There was received from the sale of maps $2.

The project has been completed and has resulted in making a channel 9 feet deep at mean high water and 100 feet wide from East Chester Bay to Town dock; thence to Lockwoods somewhat less than 100 feet wide; and thence to a point 3,000 feet above Lockwoods, 100 feet wide. The channel above Lockwoods had deteriorated to such extent that the expenditure under the last appropriation resulted in restoring only about 75 feet in width in this section of the creek to its projected depth. Considerable shoaling has also occurred in the channel below Lockwoods.

The appropriation recommended is to be applied to maintenance.

The maximum draft that could be carried over the shoalest part of the channel on June 30, 1909, is estimated at 9 feet at mean high water in mid-channel. Mean range of tides is 7.1 feet. The head of navigation is at the upper end of the artificial channel. The total length of navigable channel is about 2¼ miles.

The tonnage and value of the commerce of this creek, mainly in coal, building material, and miscellaneous freight, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1896	94,928	$2,199,186	1905	206,275	$1,755,850
1899	286,428	1,957,224	1906	282,655	3,063,360
1902	99,750	870,500	1907	354,019	1,954,254
1903	104,655	572,800	1908	273,369	2,864,000
1904	146,955	963,263			

The effect of this improvement has been to increase the number of firms carrying on business along this stream. So far as has been

learned this improvement has made no change in freight rates, but commerce has greatly increased.

CONSOLIDATED.

July 1, 1908, balance unexpended	$41,548.63
Received from sales	2.00
	41,550.63
June 30, 1909, amount expended during fiscal year, for works of improvement	29,485.01
July 1, 1909, balance unexpended	12,065.62
July 1, 1909, outstanding liabilities	174.77
July 1, 1909, balance available	11,890.85
Amount (estimated) required for completion of existing project	6,485.00

Report on a recent survey of East Chester Creek is printed in House Document No. 1250, Sixtieth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 16, 1908.

SIR: I have the honor to submit herewith, for transmission to Congress, reports of August 24, 1907, and November 30, 1908, by Col. John G. D. Knight, Corps of Engineers, on preliminary examination and survey, respectively, authorized by the river and harbor act approved March 2, 1907, of East Chester Creek, New York, with a view to obtaining a depth of 12 feet.

Improvement of East Chester Creek, under a project which provided for securing a channel 100 feet wide and 9 feet deep at mean high water from deep water in East Chester Bay to a point 3,000 feet above Lockwoods, has been completed and is now being maintained.

The present investigation was authorized with a view to obtaining a depth of 12 feet at mean low water; but on account of the known high cost of effecting an improvement to this extent, the local officer was authorized to prepare estimates for the alternative depths of 12 feet at mean low water and 12 feet at mean high water (5 feet at mean low water). These estimates are given in the survey report of November 30, 1908, as $437,000 and $103,000, respectively, with estimates of $5,000 and $3,000, respectively, for annual maintenance after completion.

From the facts and for the reasons given I concur in the opinion of the district officer and the Board of Engineers for Rivers and Harbors that East Chester Creek is worthy of further improvement by the General Government to the extent of providing a channel about 12 feet deep at mean high water (5 feet at mean low water), of dimensions and locations substantially as set forth in the report herewith, at an estimated cost of $103,000 and $3,000 a year for maintenance.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

BROWNS CREEK, NEW YORK.

This is a narrow stream which empties into Great South Bay, Long Island, near Browns Point. It had originally a depth of from 1 to 3 feet at low water, a bar at the mouth having less than 1 foot.

The project for improvement, adopted September 19, 1890, provides for a channel 100 feet wide and 4 feet deep, to extend from deep water in the bay up to Sayville highway bridge, and to be protected at the entrance by jetties on both sides. Estimated cost, $46,000.

Up to June 30, 1909, $31,301.86 had been expended on the project, of which amount $6,301.86 was for maintenance.

There was recived from the sale of maps $1.38.

About 54 per cent of the work proposed under the project has been completed, resulting in the building of two jetties at the entrance and

in the dredging of a channel 100 feet wide and 4 feet deep at mean low water for a distance of 3,200 feet from the entrance. Because of shoaling, this dredged channel was redredged in 1905 to 4 feet depth at mean low water for a distance of about 1,200 feet from the end of the jetties.

The west jetty is 492 feet long and the east jetty 438 feet long, both with top width of 3 feet at 1 foot above high water, and both partly covered at the shore end by accretion. They are in bad condition.

Disbursements during the year were in payment of office expenses and of the cost of an examination of the locality.

The available funds and additional appropriation recommended are to be applied to maintenance.

The maximum draft that could be carried over the shoalest part of the dredged channel at mean low water June 30, 1909, is about 2½ feet; mean range of tides, 1 foot. The head of navigation is at the Sayville highway bridge, about 1⅛ miles from the mouth.

Because of rapid deterioration, due mainly to the inflow of mud from the marshes bounding the channel, $6,204.83 has already been expended in redredging, and the jetties, built only to about one-third of their projected lengths, are in a very bad condition.

The total cost of completing the project will be much greater than the original estimate, and if the channel, which is now only 3,200 feet long and requires redredging, is extended upstream, the expenditure for maintenance will increase proportionately.

Considering the limited number of vessels using this creek for transportation purposes, the cost of improving and maintaining the entire length of the creek to Sayville, and completing the breakwaters as projected, would be out of proportion to the benefits to be derived therefrom. It is therefore recommended that future appropriations be made, not for extending the improvement, but only for maintaining the present dredged channel.

The tonnage and value of the commerce of this creek, mainly in coal, building materials, and fish, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1898	10,700	$213,800	1904	24,000	$807,075
1899	11,642	251,350	1905	51,675	1,811,195
1901	17,025	454,500	1906	29,675	983,880
1902	17,630	299,300	1907	34,975	1,043,865
1903	20,380	609,450	1908	25,240	924,780

This improvement has resulted in providing a harbor for fishing boats, but has had no appreciable effect on freight rates.

July 1, 1908, balance unexpended	$4,795.17
Received from sales	1.38
	4,796.55
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	97.03
July 1, 1909, balance unexpended	4,699.52
Amount (estimated) required for completion of existing project	16,301.86
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	3,000.00

EAST RIVER AND HELL GATE, NEW YORK.

East River, a tidal strait separating New York City from Long Island, extends from the Battery to Throgs Neck, a distance of about 16 miles. In its original condition it was obstructed by rocks and reefs, especially in the part known as Hell Gate.

The improvement of this waterway was commenced in 1852, under a project prepared in 1848, which contemplated the removal of rocks at Hell Gate and Diamond reef. The amount expended under this project was $33,861.59.

The existing project for improvement, adopted in 1868, and modified in 1870, 1874, 1884, 1889, 1891, and 1899, provides for the removal of rocky obstructions from the channel between the Battery and Baretto Point to depths varying from 18 to 26 feet, and for the construction of sea walls and dikes where necessary to guide the tidal currents. The cost of the work was estimated at $5,639,120. This is the estimated cost for removal of reefs and rocks only at Hell Gate, Diamond and Coenties reefs, and Man-o'-War rock. But from time to time other obstructions have been removed with the approval of higher authority, though no addition has been made to the estimated cost of the project. The locations of these obstructions are reported below. To these works should be added the construction of a crib between Great and Little Mill rocks, and the dredging of channels connecting the main channel with the posts of Davids Island and Fort Totten. The cost of this extra work, extending over a period of twenty-seven years, is $575,416. The amount required to complete the project is therefore increased in this report by that amount, less $335,466, not required under the estimate for removing Man-o'-War rock, or a net increase of $239,950.

Up to June 30, 1909, $4,883,519.97 had been expended; of this amount, $4,308,005.95 had been expended on the present project for improvement; $98.02 was for maintenance, and the balance, $575,416, on the works above enumerated not included in the original project. There was received from sales of condemned property and maps $1,336.25.

About 73 per cent of the work proposed under the present project has been completed and has resulted in the removal to the contemplated depths of Diamond reef, off Governors Island; Coenties reef, off Coenties slip; Third street reef; Pilgrim rock, off Twentieth street; Charlotte rock, off Hunters Point; Man-o'-War rock, off Thirty-ninth street; Hallets Point, Ways reef, Shell Drake, and Scaly rock, in Hell Gate; North Brother Island reef; reef off Baretto Point; and in the partial removal of the following:

Localities.	Least original depth.	Least present depth.	Least proposed depth.
	Feet.	*Feet.*	*Feet.*
Battery reef	12.8	12.8 to 26+	26
Reef off South Ferry slips	17.0	19 to 26+	26
Shell reef off Tenth to Nineteenth streets	7.5	13	18
Ferry reef off Thirty-fourth street	7	24	26
Middle reef (including Flood rock, Gridiron, Hen and Chickens, and Negro Heads)	+ 6	18.3	26
Frying Pan reef	11	18	26
Pot rock	20	22.8	26
Heel Tap	12.1	20.5	26

The available funds and additional appropriation recommended are to be applied to making a resurvey of such part of the present project as may be necessary, including any ledge or ledges of rock near to the westerly shore, in completing the removal of Pot rock, and Frying Pan reef, nearly all of Middle reef, and in removing parts of obstructions above enumerated as not completed.

The maximum draft that could be carried at mean low water June 30, 1907, through the main channel from the Battery to Long Island Sound is estimated at 26 feet. The length of this waterway is about 16 miles. The range of tide south of Hell Gate is from 4½ to 5 feet, and east of it from 5 to 7 feet.

The traffic in East River is very great, and is intimately connected with that of New York Harbor proper. It is impracticable to show what proportion belongs to East River, especially as the heaviest coastwise traffic is carried on in vessels which do not enter or clear at the custom-house.

The improvement of the river has been of great benefit to both local and through traffic, which is very large in amount; its effect on freight rates can not be determined.

Attention is invited to the report of the district engineer relative to the desirability of removing obstructions in the channel between South Brother Island and Lawrence Point and of increasing the present depth of about 18 feet over Middle Ground to 26 feet; and to providing a channel of 26 feet between North and South Brother islands. These suggested improvements are deemed worthy of consideration.

July 1, 1908, balance unexpended	$384,462.44
Received from sales	.50
	384,462.94
June 30, 1909, amount expended during fiscal year, for works of improvement	83,305.21
July 1, 1909, balance unexpended	301,157.73
July 1, 1909, outstanding liabilities	9,237.66
July 1, 1909, balance available	291,920.07
July 1, 1909, amount covered by uncompleted contracts	161,662.04
Amount (estimated) required for completion of existing project	1,031,390.59
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	300,000.00

Report on a recent survey is printed in House Document No. 1084, Sixtieth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, October 30, 1908.

SIR: Under authority conferred by section 3 of the river and harbor act approved March 2, 1907, I have the honor to submit herewith, for transmission to the Public Printer, reports of April 9, 1907, by Col. D. W. Lockwood, Corps of Engineers, and of April 30, 1908 (with map), by Col. John G. D. Knight, Corps of Engineers, on preliminary examination and survey, respectively, ordered by said act of March 2, 1907, of East River, New York, "between North Brother and South Brother islands, with a view to obtaining depths of 20, 22, and 24 feet."

In his survey report of April 30, 1908, Colonel Knight presents estimates of cost of securing channels at this locality for each of the depths named in the act, namely, $216,100, $485,990, and $750,262, for the depths 20, 22, and 24 feet, respectively.

In his opinion East River between North Brother and South Brother islands is worthy of improvement by the General Government to the extent of obtaining a depth of 24 feet, and this opinion is concurred in by the Board of Engineers for Rivers and Harbors and by the Chief of Engineers.

The object of the improvement now proposed is to provide an alternative channel at a locality lying within the limits of the existing project for improving East River and Hell Gate. The project depth for all the important channels under this project is 26 feet, and in the opinion of Colonel Knight the General Government would, therefore, be warranted in extending the improvement now under consideration to the same depth of 26 feet, and he includes in his report an estimate of the cost of the necessary work to procure that depth. The Board of Engineers for River and Harbors also expresses the opinion that economical considerations would justify obtaining in the first instance the same depth for this alternative channel as that authorized for East River throughout.

While some doubt exists as to the propriety of presenting to Congress an estimate for work in excess of that specifically named in the item of law authorizing this investigation, in view of the fact that the unit of cost of the additional excavation, if authorized at a later date, would be much larger than if it had been originally carried to the greater depth, I am constrained to permit the estimate for 26-foot depth to go before Congress for such consideration as it may be entitled to.

I recommend, however, that in case any degree of improvement be authorized in accordance with the report and estimates submitted herewith, the same be ordered as an extension to the project now in force for improving East River and Hell Gate rather than as a separate work.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

Following is the report of the Board of Engineers in House Document No. 1187, Sixtieth Congress, second session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., November 23, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

The within preliminary report on resurvey of East River, authorized by the river and harbor act of March 2, 1907, covers a serious shoal in the East River, on which sufficient information is at hand to base an estimate of cost of its removal. Report as to other needs will be submitted, it is stated by the district officer, as soon as the necessary fieldwork can be completed.

The magnitude and importance of the commerce of East River are sufficient, in the opinion of the Board, to justify any reasonable expenditure deemed necessary for the safety and convenience of that commerce. One of the greatest obstructions to safe navigation is the shoals near the entrance to Little Hell Gate, the removal of which to a depth of 26 feet the district officer estimates will cost about $1,733,000.

The Board concurs with the district officer in believing East River to be worthy of further improvement to this extent.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

HARLEM RIVER, NEW YORK.

The Harlem River and Spuyten Duyvil Creek, both included in the improvement, are two waterways of a joint length of about 8 miles which join at Kingsbridge, N. Y., and separate Manhattan Island from the mainland. The narrow channel at their junction was obstructed by a ledge of rocks awash at low tide.

Before improvement the Harlem River had an available depth of 10 feet at mean low water from the East River to Morris dock, except at Highbridge, where it was only 6 feet deep. From Morris dock to Fordham Landing there was a crooked channel 7 feet deep, and above the latter place the river could be used only by the smallest class of vessels. Spuyten Duyvil Creek from Kingsbridge to the Hudson had a depth of 4 feet.

The original project for improvement, adopted in 1874, provided for the removal of old bridge piers, Candle Factory reef, and bowlders at various places near the East River to a depth of 12 feet, the cost of the work being estimated at $167,875.56. In furtherance of this project $21,000 was expended.

The existing project, adopted June 18, 1878, and modified October 7, 1886, provides for a continuous channel 400 feet wide and 15 feet deep from the East River to the Hudson River, except about 1,300 feet north of Highbridge, where the width was made 375 feet, and at the rock cut through Dyckmans Meadow, where the width was reduced to 350 feet and the depth increased to 18 feet. Estimated cost, $2,700,000.

On June 30, 1909, $1,530,824.50 had been expended on the present project, all for improvement. There was received on account of reimbursements for damages to government property $108.97, and from the sale of maps $2.10.

About 57 per cent of the work proposed under the present project has been completed, resulting in making a channel 15 feet deep at mean low water and width of about 400 feet from Willis Avenue Bridge to the Madison avenue permanent bridge except immediately north of the easterly pier of the Second Avenue Bridge, where ledge rock projects above the improvement plane; thence to One hundred and forty-fifth Street Bridge the same depth and 250 to 300 feet in width; thence to Macombs Dam Bridge the same depth and 150 feet in width. The available depth through the westerly draw channel at Macombs Dam Bridge is about 12 feet; the channel through the easterly draw opening is not navigable, being obstructed by a rocky ledge which projects above the low-water plane to within a short distance of the rest pier. Below Willis Avenue Bridge between One hundred and twenty-second and One hundred and twenty-sixth streets, the channel of 15 feet depth is about 100 feet wide; both above and below this section of the river the width rapidly increases to 400 feet and over. In 1907 a channel 15 feet deep and 150 feet wide was dredged from Macombs Dam Bridge to the Hudson River; it is probable that since this work was completed the channel has been narrowed by the filling in of material from the sides. The rock cut through Dyckmans Meadow has been completed.

The available funds and additional appropriation recommended are to be applied to continuing the improvement at and east of Macombs Dam Bridge.

The maximum draft that could be carried June 30, 1909, through the channel from East River to Hudson River at mean low water is estimated at 15 feet, except through the channel at Macombs Dam Bridge, where the depth is but about 12 feet.

The tonnage and value of the commerce of this river, which is general in character, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1895	7,533,594	$203,707,376	1906	11,385,649	(?)$104,359,757
1903	6,910,386	282,186,100	1907	12,385,507	313,380,743
1904	9,130,763	231,384,004	1908	[a]43,768,658	410,100,000
1905	9,998,021	270,210,309			

[a] Increase due to failure in past on the part of large transportation interests to respond to requests in past years for statistics.

The principal benefit derived from the improvement has been in the way of increased facilities for handling shipments, which make a material saving in the cost of transportation.

July 1, 1908, balance unexpended	$98,500.14
Collection damage to drill scow *Hudson*	67.80
Amount allotted from appropriation by river and harbor act approved March 3, 1909	22,000.00
	120,567.94
June 30, 1909, amount expended during fiscal year, for works of improvement	84,281.37
July 1, 1909, balance unexpended	36,286.57
July 1, 1909, outstanding liabilities	8,252.80
July 1, 1909, balance available	28,033.77
July 1, 1909, amount covered by uncompleted contracts	11,919.40
Amount (estimated) required for completion of existing project	1,133,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	300,000.00

HUDSON RIVER, NEW YORK.

The portion of this river which is now under improvement is the stretch beginning at the state dam at Troy and extending downstream to Coxsackie, a distance of 28 miles. In its natural condition the channel was narrow and crooked, with a navigable depth of 4 feet between the state dam and Albany, of 7½ feet between Albany and New Baltimore, of 11 feet between New Baltimore and Coxsackie, and of 12 feet or more below Coxsackie.

The original project for improvement, adopted in 1834, modified in 1852 and again in 1866, had for its object the securing of a navigable channel of sufficient width and 9 feet deep between Troy and Albany, and 11 feet deep between Albany and New Baltimore. In carrying out this work $1,667,938 was expended.

The existing project, adopted July 13, 1892, and modified March 3, 1899, provides for a 12-foot channel 150 feet wide from the state dam to the foot of Jacob street, Troy; thence gradually increasing in width to 400 feet at the foot of Broadway, Troy; thence 400 feet wide to Coxsackie. This work was estimated to cost $4,343,863. The act of March 3, 1905, authorized the expenditure, in the discretion of the Secretary of War, of $85,000 of the amount appropriated by that act for improving Hudson River, for the removal of Stonehouse bar, opposite New Baltimore. Forty thousand two hundred and eighty-eight dollars and forty-two cents has been expended on this work. The same act authorized the expenditure of not exceeding $10,000 in providing a channel for access to the harbor of Tarrytown, all of which amount has been expended under this authority. The act of March 2, 1907, authorized the expenditure of $5,000 in removing the bar and deepening the channel at the mouth of Schodack Creek. Under this authority $4,432.37 was expended.

On June 30, 1909, $3,740,335.60 had been expended; of this amount $3,705,202.14 had been expended on the present project, of which $313,497.48 was for maintenance; and the balance, $54,720.79, on the works above enumerated not included in the project. There was received from sales of maps, $86.52; from sale of typewriter,

$35; from repayments, $10.06; from reimbursements on account of removal of obstructions from the channel, $78.10.

About 85 per cent of the work proposed under the present project has been completed, resulting in a navigable channel of not less width than 190 feet, and maximum depth of 12 feet at mean low water from Coxsackie to the Delaware and Hudson Company's bridge at Troy, N. Y., except at the New York Central and Hudson River Railroad Company's freight bridge at Albany, where the channel through the draw spans is contracted to a maximum of 90 feet; and a depth of 11 feet and width of 75 feet from the Delaware and Hudson Company's bridge to within 900 feet of the sloop lock at the state dam. The depth over the miter sill of the sloop lock is 4½ feet.

The range of the tides in seasons of moderate rain varies from 2.55 feet at the state dam, 2.89 feet at Broadway, Troy, 2.84 feet at Albany, to 3.69 feet at Coxsackie, being an increase in elevation of high water of about 0.5 foot at Albany and at the foot of Broadway, Troy. The head of navigation for the tidal portion of the river is at the state dam, 153 miles from the Battery in New York City. The total length of navigable channel under improvement is 28 miles.

For results of previous tidal observations, reference is made to the Report of the Chief of Engineers for 1897, page 998, and 1900, page 1490.

The commerce within the limits of the improvement, mainly in general merchandise, farm products, building material, fuel, and ice, amounted to 3,325,360 tons, valued at $75,664,748 in 1906, to 2,881,168 tons, valued at $66,853,731 in 1907, and to 2,945,921 tons, valued at $120,421,651 in 1908.

The effect of the improvement has probably been to reduce freight rates.

The available funds and additional appropriation recommended are to be applied to continuing the improvement and to maintenance.

July 1, 1908, balance unexpended		$196,689.19
Received, sale of maps, $35.02; sale of property, $35		70.02
Amount allotted from appropriation by river and harbor act approved March 3, 1909		39,000.00
Received by collection		4.45
		235,763.66
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$145,772.44	
For maintenance of improvement	34,310.58	
		180,083.02
July 1, 1909, balance unexpended		55,680.64
July 1, 1909, outstanding liabilities		18,688.53
July 1, 1909, balance available		36,992.11
July 1, 1909, amount covered by uncompleted contracts		3,152.90
Amount (estimated) required for completion of existing project		951,408.17
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		350,000.00

The following is from the report of the House committee:

In the act of March 3, 1909, a survey was ordered for the Hudson River, providing for a depth of 12 feet at the lowest stage of water. This improvement is to furnish a suitable outlet for the 1,000-ton barge canal now being constructed by the State of

New York at an expense of $101,000,000. It is regretted that the report of the engineers did not reach the committee in time for the adoption of this project, but the committee is advised that it will be submitted to Congress in time for action by the Senate Committee on Commerce; and that an appropriation will then be inserted in this bill by that committee, suitable to the magnitude of this great work, is the belief of this committee. An important section of the state barge canal will be opened before the close of navigation in 1914, and in order to have a sufficient channel for barges to pass unvexed to the sea, it is absolutely essential that work in the Hudson River begin in 1910.

NEWTOWN CREEK, NEW YORK.

This creek, an inlet of the East River, extending inland between Kings and Queens counties, N. Y., for a distance of about 4 miles, had a natural depth varying from 12½ feet at the mouth to 4 feet at the head of navigation.

The original project, adopted in 1880 and modified in 1884, provided for a channel 240 feet wide and 21 feet deep from the mouth to the Vernon Avenue Bridge; thence to the head of navigation on both branches or channels decreasing from 175 to 100 feet in width and from 18 to 10 feet in depth. The cost of the work was estimated at $255,500. In carrying out this project $197,500 was expended.

The existing project, adopted June 3, 1896, is to secure a uniform channel, 125 feet wide and 18 feet deep, from the East River to the head of navigation in the creek and in English Kills at the Metropolitan avenue bridges, at an estimated cost of $450,000. This estimate was subsequently reduced to $228,000.

Up to June 30, 1909, $221,364.88 had been expended on the project. Of this amount $21,420.31 was for maintenance.

About 94 per cent of the work proposed under the present project has been completed, resulting in a channel of the projected width and depth, with the exception of some widening at the entrance. The dredged channel has deteriorated to a considerable extent.

The available funds and additional appropriation recommended are to be applied to completing the improvement and to maintenance.

The maximum draft that could be carried over the shoalest part of the channel June 30, 1909, at mean low water is probably not more than 16 feet. The mean range of tides is about 4½ feet. The total length of navigable channels is about 4 miles. The head of navigation in the creek and kills is at the Metropolitan avenue bridges.

The tonnage and value of the commerce of this creek, mainly in coal, building materials, oil, and general merchandise, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1903	2,675,025	$90,535,640	1906	2,803,380	$214,714,751
1904	3,771,726	108,313,377	1907	3,108,374	175,229,346
1905	3,428,404	130,812,974	1908	4,181,528	229,994,000

The increased depth resulting from this improvement has greatly benefited commerce.

Freight rates have been reported as greatly reduced by this improvement. It is difficult if not impracticable to ascertain details;

but the large and valuable commerce of this water is the best index to the effect of the improvement.

Amount that can be profitably expended in fiscal year ending June 30, 1911, exclusive of the balance unexpended July 1, 1909, for maintenance of improvement..... $10,000

NIAGARA RIVER, NEW YORK.

From the foot of Tonawanda Island to Gill Creek is approximately 7¾ miles, the bottom being composed of hardpan and rock ledges. A navigable channel of 12 feet depth and 200 feet wide, except across Cayuga Island shoal where the width is from 150 to 170 feet, is now available from Tonawanda to Schlosser's dock, about 2,000 feet above Gill Creek.

The present commerce consists of about 20,000 tons of pulp wood, valued at $40,000, and about 3,000 tons of other commodities.

The passenger business using this channel consists of excursions from Buffalo on steamers of 6 to 8 feet draft, usually accompanied by a picnic barge of 2 to 4 feet draft towed alongside. During the season of about four months, June to September, from one to five of these vessels daily carry parties down the American channel, around the foot of Grand Island, and return to Buffalo by the Canadian channel; occasionally a party is landed at Schlosser's dock. This passenger business will probably continue and may increase with the increase of population along the Niagara frontier.

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 75, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., June 24, 1907.

Respectfully returned to the Chief of Engineers, United States Army.

In the within report the district officer estimates that the channel across Cayuga Island shoal can be completed to the full width of 200 feet and depth of 12 feet at mean river level, as contemplated by the modified project of August 18, 1894, at a total cost of $10,000.

The statistics furnished by the district officer indicate that only a small amount of commerce has hitherto been carried on the American channel between Tonawanda and Niagara Falls. The locality is one which is rapidly being developed, owing to the establishment of manufactories, which are attracted by the cheap electrical power generated at the Falls. With the completion of the enlarged Erie Canal it is probable that further impetus will be given to industrial activity along the shore of Niagara River, and it seems desirable that the American channel between the terminus of the Erie Canal and Niagara Falls should be available for such traffic as now exists or which may be created in the future.

As the cost of completing this improvement is small and the character of the river bed is such that no expense for maintenance need be considered, the Board is of the opinion that it is advisable for the United States to undertake the work in accordance with the plan presented by the district officer.

WAPPINGER CREEK, NEW YORK.

Wappinger Creek is a small stream which empties into the Hudson River from the east about one-half mile below the village of New Hamburg, N. Y.; it is navigable from its mouth for a distance of about 2 miles to the works of the Dutchess Company, which are located just below the falls and at the head of navigation. The entrance to the creek is through a drawbridge over which passes the New York Central and Hudson River Railroad. The depth before improvement did not exceed 6 feet, and the width of channel varied from 25 to 75 feet.

The original project for improvement, adopted September 19, 1890, provided for a channel 8 feet deep at mean low water and 80 feet wide, at an estimated cost of $13,000. The project was completed April 30, 1892, at a cost of $13,000, and resulted in making a channel of the projected width and depth.

The expenditures during the past fiscal year were for resurvey of the creek, examining new drawbridge, etc.

Up to June 30, 1909, $18,849.34 had been expended on the project; of this amount, $5,849.34 was for maintenance.

To maintain the channel width and depth as projected repeated redredging is necessary. A recent survey of the creek from its mouth to the falls shows that shoaling has occurred to such extent the expenditure of the balance of funds available for this work would not result in a material benefit to navigation. It is therefore proposed to delay further work until additional funds are made available by act of Congress.

During the past year the New York Central and Hudson River Railroad Company completed the erection of a new draw of 40 feet horizontal clearance a short distance south of the old draw span, and connected the new location with the channel improved by the United States by dredging to a depth of 8 feet at mean low water, except for a few minor obstructions in the draw opening which have yet to be removed by the railroad company.

The available funds and additional appropriation recommended are to be applied to maintenance.

The greatest draft that can be carried, June 30, 1909, at mean low water from deep water in the Hudson River to the head of navigation is about 7 feet. The mean rise and fall of tides at the mouth of the creek is about 3.3 feet. The total length of navigable channel is about 2 miles.

The tonnage and value of the commerce of this creek, mainly in cotton goods, clothing, building material, and fuel, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1904	56,927	$7,955,975	1907	44,493	$445,765
1905	49,562	4,872,903	1908	41,574	[a] 6,990,600
1906	46,194	572,399			

[a] Increase due to more accurate returns from interested parties for 1908 than for 1906 and 1907.

It is reported that commercial interests have been greatly benefited by the improvement, but no reduction in freight rates has resulted therefrom.

July 1, 1908, balance unexpended	$3,000.00
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,349.34
July 1, 1909, balance unexpended	1,650.66
July 1, 1909, outstanding liabilities	16.71
July 1, 1909, balance available	1,633.95
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	5,000.00

WESTCHESTER CREEK, NEW YORK.

The following is printed in Rivers and Harbors Committee Document No. 7, Sixty-first Congress, second session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., April 15, 1907.

GENERAL: 1. By your reference the Board has had under consideration a resolution of the Committee on Rivers and Harbors of the House of Representatives, requiring among other things the opinion of the Board in reference to the improvement of Westchester Creek, New York, as follows:

"*Resolved, by the Committee on Rivers and Harbors of the House of Representatives,* That the Board of Engineers for Rivers and Harbors created by the act of June thirteenth, nineteen hundred and two, be, and it is hereby, requested to further consider the examinations and surveys for the improvement of the following-named rivers and harbors, and to report its conclusions thereon. * * *."

2. Pursuant to the request of the Committee on Rivers and Harbors, the Board has carefully reviewed the reports on preliminary examinations and surveys heretofore made of Westchester Creek, and has had before it a letter recently received from the district officer giving information as to existing conditions and the commercial development of the locality.

3. Two investigations of this stream have been authorized by law. The act of September 19, 1890, ordered a preliminary examination of "Westchester Creek, Westchester and New York counties," the report on which was submitted by Lieut. Col. G. L. Gillespie, Corps of Engineers, under date of September 29, 1890. The locality being considered worthy of improvement, a survey was made and an estimate of cost amounting to $27,500, presented for the work deemed necessary. The act of March 3, 1899, ordered a preliminary examination of "Westchester Creek," the report on which was submitted under date of September 15, 1899, by Lieut. Col. W. H. H. Benyaurd, Corps of Engineers. Colonel Benyaurd found that conditions had not materially changed since the former examination, and reported that a plan and estimate of cost of the improvement of this stream, which he deemed advisable, could be submitted without further survey. A project for improvement substantially the same as that recommended by Colonel Gillespie was presented in his report of November 28, 1899, as follows:

For dredging a channel 8 feet deep at mean low water and 100 feet wide across the estuary	$7,200
For dredging a channel 8 feet deep at mean low water and 80 feet wide, from the estuary to a point about 1,000 feet above Scriven's dock	3,000
For dredging a channel 8 feet deep at mean low water and 60 feet wide, from a point about 1,000 feet above Scriven's dock to the head of navigation	27,000
Total (124,000 cubic yards, at 30 cents)	37,200
Contingencies, supervision, etc., 15 per cent	5,580
	42,780
For annual maintenance	2,000

The above project is designed to provide a depth of 8 feet at mean low water from deep water in East River to the wharves at Westchester, a distance of 2¾ miles, which would give a depth of 15 feet at high water.

4. In 1890 the commerce of Westchester Creek was reported to amount to 50,000 tons, valued at $242,000, being carried in canal boats, scows, and lighters drawing 5 to 8 feet. In 1899 the tonnage had increased to about double that amount, while information recently received from the district officer indicates that the commerce has increased materially since those reports were made. The bulk of the commerce consists of building materials, the importation of which naturally increases with the settling up of the contiguous territory. It is reported that the section to be benefited by this improvement has doubled its population in the last five or six years, and its proximity to New York City would appear to afford reasonable prospect of continued growth. The character of the commerce is such that it can not be economically transported on the small low-water depth now available.

5. After careful consideration the Board believes that the cost of providing a channel 8 feet deep at mean low water from East River to the wharves at Westchester is reasonable when compared with the benefits which such an improvement will

afford. The estimate of $42,780, made in 1899, may require some modification, but it is believed to be sufficiently accurate to determine the advisability of the improvement and to afford a basis for appropriation.

For the Board:

Very respectfully,

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. Army,
Washington, D. C.

ARTHUR KILL, OR STATEN ISLAND SOUND, AND CHANNEL BETWEEN STATEN ISLAND AND NEW JERSEY.

(*a*) *Arthur Kill, or Staten Island Sound, New York and New Jersey.*—This is a waterway about 12 miles long, which, together with the lower end of Newark Bay, 2 miles long, and the Kill van Kull, 3 miles long, forms the inland waterway between upper New York Harbor and Raritan Bay. The section now contemplated under this improvement consists of the 14 miles of channel between Kill van Kull and Raritan Bay. The original depth through the Arthur Kill, or Staten Island Sound, at mean low water was 15 feet and upward, in a channel 100 to 1,000 feet in width. Through the lower end of Newark Bay the navigable channel depth was about 14 feet at mean low water, the result of an improvement commenced in 1874 and continued up to the present time. In the present project the new channel was cut through the flats to the southward of the original channel, on which the depth was 1 to 2 feet at mean low water.

Projects: Sections of this waterway have been under improvement by the United States under the titles of "Channel between Staten Island and New Jersey," adopted in 1880, superseding the project of 1874, and "Arthur Kill," adopted in 1888. The former provided for a depth of 14 feet and width of 400 feet through the lower part of Newark Bay, and the latter for the removal of Steep Point, in order to straighten the channel to the southwestward of the Baltimore and Ohio Railroad bridge.

Details and references as to these projects are printed in current report under the head of "Channel between Staten Island and New Jersey," which project is still in force.

The existing project for this improvement, adopted by the river and harbor act approved June 13, 1902, provides for making and maintaining a channel from Kill van Kull to Raritan Bay, New York and New Jersey, by means of dredging and diking, 300 feet wide and 21 feet deep at mean low water, at an estimated cost of $696,000, and $5,000 for annual cost of maintenance. Work under this project is authorized to be done under continuing contracts, $91,000 of the authorization still remaining to be appropriated. The amount expended on the project to June 30, 1909, was $446,924.43; of this amount $22.10 was derived from the sale of maps.

Operations during the past fiscal year consisted in dredging, under a continuing contract, approved by the department on October 27, 1903, upon which work was commenced on December 2, 1903. During the year 593,926 cubic yards of material were removed from several sections of the channel between Shooters Island and Carteret. About six-sevenths of the dredging contemplated by this project has been completed, and the 21-foot channel has been dredged through

the waterway, with widths of about 300 feet. Shoaling in the upper part of the channel, particularly in the vicinity of Corner Stake light, has reduced the depth to about 18 feet at mean low water. This will be redredged under contract in force and in progress.

The maximum draft that could be carried through the waterway on June 30, 1909, was 18 to 20 feet at mean low water. Mean range of tides, 5 feet.

It is proposed to apply the amount estimated as a profitable expenditure to rock removal in continuing the improvement and to dredging for maintenance in accordance with the adopted project.

The freight carried through this waterway consists of oil, coal, ores, clay products, chemicals, fertilizers, grain, machinery, manufactures, and general merchandise, and amounted in 1899 to 11,311,991 tons, in 1900 to 11,047,633 tons, in 1901 to 11,651,300 tons, in 1902 to 14,517,079 tons, in 1903 to 11,512,420 tons, in 1905 to 11,721,861 tons, valued at $265,193,813, in 1906 to 16,574,840 tons, valued at $355,579,817, in 1907 to 14,948,077 tons, valued at $245,032,666, and in 1908 to 15,995,231 tons, valued at $239,395,113. Tonnage reported heretofore in gross tons; reported this year in short tons.

It appears from inquiry that no estimate can be made of the exact effect of the project on freight rates, except to the local commerce. The rates on this have been reduced by this improvement, and will be further reduced when the improvement has advanced to the extent of providing a practicable navigable channel of 21 feet.

(*b*) *Channel between Staten Island and New Jersey.*—This channel is an inland waterway, about 17 miles long, connecting New York Harbor with Raritan Bay. It consists of the Kill van Kull, connecting the upper bay with Newark Bay, and the Arthur Kill, connecting Newark Bay with Raritan Bay.

The natural depth through the channel was 15 feet or more, except for a distance of about 1¼ miles in Newark Bay, where there was a shoal with a crooked channel 9½ feet deep, bordered by flats with depth of about 2 feet of water. The improvement of the "channel between Staten Island and New Jersey" consists in the deepening of the channel across this shoal.

The first project, adopted by the river and harbor act of June 23, 1874, was for making this channel from 14 to 16 feet deep, at an estimated cost of $443,211. The only work done under it was the building of 2,237 linear feet of diking, at a cost of $50,000.

The second and existing project was adopted in 1880, which, with subsequent modifications, proposed to dredge through the shoal a channel 400 feet wide and 14 feet deep at mean low water, the cost being estimated at $210,000.

A supplemental project was adopted by the river and harbor act of August 11, 1888, which had for its object the removal of the point of land known as "Steep Point," for the straightening of the channel to the westward of the Baltimore and Ohio Railroad bridge. The work was carried on under the title of "Improvement of Arthur Kill, New York and New Jersey," 1888–1895. The cost was estimated at $26,500, and the work was completed in 1895, at a cost of $25,401.30. This modification of the project brought the total cost of the improvement up to $286,500.

The river and harbor acts of June 3, 1896, and June 13, 1902, extended the project to include the dredging of a channel in Lemon Creek, on Staten Island, at a cost of $5,000 and $5,000, respectively.

This extension increased the total estimated cost of the improvement from the beginning to $296,500. Annual maintenance is estimated at $10,000.

The total amount expended to June 30, 1909, on the project, with its additions and modifications, was $308,829.84, which was applied to diking, to dredging a channel 14 feet deep and 400 feet wide through the shoal in Newark Bay, to removing Steep Point, and to dredging a channel in Lemon Creek 8 feet deep at high water and from 35 to 50 feet wide; $206,635.08 has been expended in carrying out the project and $102,194.76 for maintenance. The work contemplated under this project has been completed.

No work was done during the fiscal year, the expenditure being for expenses connected with harbor line hearing; the channel was reported to be in good condition, the result of dredging in the seasons of 1906–7.

It is proposed to apply the available balance and the amount recommended as a profitable expenditure to the maintenance of the improvement.

The maximum draft that could be carried June 30, 1909, through the channel between Staten Island and New Jersey was about 14 feet at mean low water, and in Lemon Creek about 6 feet at mean high water to the head of navigation, a distance of about one-half mile from the mouth. Mean range of tides, 5 feet.

The freight carried through this channel consists of oil, coal, ores, clay products, chemicals, fertilizers, grain, machinery, manufactures, and general merchandise, and amounted in 1899 to 11,311,991 tons, in 1901 to 11,651,300 tons, in 1902 to 16,266,574 tons, in 1903 to 14,129,678 tons, in 1905 to 14,339,120 tons, valued at $325,625,465, and in 1906 to 17,097,799 tons, valued at $396,266,084. No report has been received since 1906. A part of the commerce now passes through the new "Arthur Kill channel," which has been dredged south of the old channel and Corner Stake light.

The commerce of Lemon Creek as given by the last report in 1907 has an estimated value of $435,000; number of vessels in use, 50 to 75, draft 3½ to 6 feet, with a valuation of $145,000.

CONSOLIDATED.

July 1, 1908, balance unexpended		$116,261.61
Amount appropriated by sundry civil act approved March 4, 1909		150,000.00
Received from sale of maps during the year		5.80
		266,267.41
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$105,465.48	
For maintenance of improvement	33.40	
		105,498.88
July 1, 1909, balance unexpended		160,768.53
July 1, 1909, outstanding liabilities		31,365.00
July 1, 1909, balance available		129,403.53
July 1, 1909, amount covered by uncompleted contracts		83,982.94
Amount (estimated) required for completion of existing project		91,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, exclusive of the balance unexpended July 1, 1909:		
For works of improvement	$30,000.00	
For maintenance of improvement	30,000.00	
		60,000.00

KEYPORT HARBOR, MATAWAN CREEK, RARITAN AND SOUTH RIVERS, SHOAL HARBOR AND COMPTON CREEK, AND CHEESEQUAKE CREEK, NEW JERSEY.

(*a*) *Keyport Harbor.*—This harbor is situated at the mouth of Matawan Creek on the south side of Raritan Bay, 5 miles east of the mouth of Raritan River, and it consists of a bay about 1 mile broad.

There was no distinct natural channel in the harbor, the available depth to the wharves being less than 4 feet at mean low water. A 6-foot channel had been dredged at private expense before the United States assumed charge of the improvement, but it had shoaled again to 3 feet.

The original and existing project, approved August 2, 1882, with subsequent modifications (1884), contemplates dredging a channel 8 feet deep at mean low water about 4,700 feet long and 200 feet wide from Raritan Bay to the steamboat dock at Keyport, at an estimated cost of $40,475. Reference to report on examination and survey is noted in the Annual Report of the Chief of Engineers for 1904, page 141.

The amount expended to June 30, 1909, was $68,197.39, of which sum $30,500 was used in carrying out the project and $37,697.39 for maintenance. A channel of the required length and nearly the proposed width was completed in 1883–84. Recent appropriations have been insufficient to maintain projected dimensions. The improvement may now be considered as about half completed.

Under an allotment of $8,705.97 from the consolidated appropriation, act of March 2, 1907, a contract for dredging was in force and preparations for beginning work were in progress at the beginning of the year. Dredging was commenced on July 9, and the contract was completed on August 26. The amount of material removed was 19,878 cubic yards. The channel was restored to 100 feet width and 8 feet depth for about one-half its length. The remainder of the channel had a depth of about 7 feet at mean low water.

The maximum draft that could be carried June 30, 1909, to the Keyport wharves was about 7 feet at mean low water. Mean range of tides, 4.9 feet.

The commerce of this harbor is mainly in farm products, fertilizers, coal, lumber, fish, shellfish, and miscellaneous freight, and amounted to 67,500 tons in 1899, to 45,000 tons in 1901, to 62,000 tons in 1903, to 70,000 tons in 1904, to 86,821 tons in 1905, valued at $2,202,105, in 1906 to 229,377 tons, valued at $3,074,060, including the commerce of Matawan Creek, in 1907 to 160,925 tons, valued at $3,275,305, and in 1908 to 123,724 tons, valued at $3,146,800. Tonnage reported heretofore in gross tons; reported this year in short tons.

The effect of this improvement has been to greatly reduce freight rates, especially in the marketing season.

It is proposed to apply the available balance, and the amount estimated as a profitable expenditure, for the completion and mainte nance of the improvement in accordance with the adopted project.

Further details as to this work are printed in the Annual Report of the Chief of Engineers for 1897, pages 1147–1148. Map is printed in the Annual Report of the Chief of Engineers for 1905, page 1040.

Amount (estimated) required for completion of existing project..... $9,975.00

(*b*) *Matawan Creek.*—This creek is a small tidal stream in the eastern part of New Jersey which discharges into Raritan Bay at Keyport Harbor. It is navigable up to the bridge of the New York and Long Branch Railroad, about 2 miles above its mouth.

In its natural condition the mouth was obstructed by a mud flat, through which a narrow and crooked 3-foot channel existed. Above this flat there was a 4-foot channel for a mile and beyond a narrow 3-foot channel extending nearly up to the head of navigation at Matawan.

The original and existing project for improving this stream, by dredging a 4-foot channel 100 feet wide from the mouth to Winkson Creek, about 1 mile, and thence 75 feet wide to the railroad bridge at Matawan, was adopted March 3, 1881. The cost was estimated at $33,120. Reference to report on examination and survey is noted in the Annual Report of the Chief of Engineers for 1904, page 141.

The amount expended to June 30, 1909, was $56,480.31, of which $21,000 was used in carrying out the project and $35,480.31 for maintenance. About two-thirds of the work proposed under the project has been completed, and a channel has been dredged the required distance with widths of 50 to 100 feet, but this channel has greatly deteriorated.

Dredging under contract was in progress at the beginning of the year, at which time 1,258 cubic yards of material had been removed near the mouth of the creek. The contract was completed on August 26. The total amount of material, mud and sand, removed in maintenance work during the fiscal year was 7,036 cubic yards. The total amount dredged under the contract was 8,294 cubic yards.

Project for expenditure of the allotment of $3,000, act of March 3, 1909, was approved March 20. Dredging for maintenance was advertised and proposals were received on June 8, 1909, and at the close of the year a contract for the proposed work was in preparation.

The maximum draft that could be carried June 30, 1909, was about 3 feet at mean low water. Mean range of tides, 4.9 feet.

The commerce of this creek is in brick and fireproofing, fertilizer, farm produce, and general merchandise, and amounted to 51,000 tons in 1899; to 60,000 tons in 1901; to 61,500 tons in 1903; to 29,600 tons in 1904; to 58,471 tons in 1905, valued at $203,955; in 1906 to 128,181 tons, valued at $717,505; in 1907 to 40,900 tons, valued at $163,500; and in 1908 to 10,167 tons, valued at $38,265. Tonnage heretofore reported in gross tons; reported for this year in short tons.

The effect of this improvement has been to greatly reduce rates of freight, especially in the marketing season. Recent appropriations have been insufficient to maintain the channel in the upper part of the creek, where the market boats load.

It is proposed to expend the available balance and the amount estimated as a profitable expenditure for completion and maintenance of the project.

Further details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1897, page 1145. Map is printed in the Annual Report of the Chief of Engineers for 1905, page 1042.

Amount (estimated) required for completion of existing project..... $1,120.00

(*c*) *Raritan River.*—This river is a moderate-sized stream flowing through the central part of the State of New Jersey and emptying

into Raritan Bay at Perth Amboy. It is navigable to New Brunswick, N. J., a distance of 12 miles, where it is the eastern terminus of the Delaware and Raritan Canal.

In its natural state the channel to New Brunswick was obstructed by several extensive shoals, on which the depth was from 6½ to 8½ feet at mean low water.

The sum of $13,963, appropriated in the years 1836 and 1837, was expended in removing obstructions from the river at New Brunswick.

The existing project for improvement, adopted June 18, 1878, with subsequent modifications, provides for a channel 200 feet wide and 10 feet deep from the mouth to the Delaware and Raritan Canal terminus at New Brunswick, including a south channel between Crab Island and Kearney's dock, with a length of about 2½ miles, width of 100 feet, and depth of 5½ feet at mean low water, to be obtained by dredging, diking, and rock excavation, the cost being estimated at that time at $2,093,662. Recent and improved methods for doing such work have made it probable that this estimate will not exceed $1,035,000. Reference to reports on surveys with estimates is given in the Annual Report of the Chief of Engineers for 1907, page 166.

The amount expended upon the existing project up to the close of the fiscal year ended June 30, 1909, was $730,306.94, of which $659,192.32 was used in carrying on the work and $71,114.62 for maintaining that already done; of this amount $1.15 was derived from sale of condemned property. About two-thirds of the work contemplated under the project has been completed, and the following work has been accomplished under the project: A channel 10 feet deep has been made from the mouth to the Delaware and Raritan Canal terminus at New Brunswick, the section through and below the reef at Whitehead's dock having a width of 200 feet and the section above the reef a width of 100 feet. South channel has been dredged to the projected depth and width for a length of about 4,000 feet. Five dikes have been built to maintain the channels.

No work was done during the fiscal year. At the close of the year contract for dredging for maintenance was in course of preparation under allotment of $10,000 from the appropriation made by the river and harbor act of March 3, 1909. Expenditures were for a survey of the south channel, as authorized, and for office expenses and contingencies.

At the close of work of 1908 the river was open to 10-foot navigation at low water.

It is proposed to apply the amount recommended as a profitable expenditure to continuing and maintaining the improvement.

On June 30, 1909, the maximum draft that could be carried to the head of navigation was 8 to 10 feet at mean low water. Mean range of tides: At mouth of river, 5.1 feet; at New Brunswick, 5.56 feet.

The commerce of this river is principally in coal, ores, refined copper, lumber, building materials, and general merchandise, and amounted in 1901 to 1,266,950 tons; in 1902, to 1,228,791 tons; in 1903, to 1,020,420 tons; in 1905, to 605,197 tons; in 1906, to 736,666 tons, valued at $17,377,645; in 1907, to 725,690 tons, valued at $32,678,472; and in 1908, to 918,302 tons, valued at $26,401,439. Tonnage heretofore reported in gross tons; reported for this year in short tons.

It appears from numerous letters received that this improvement has resulted in a very material reduction of freight rates.

Details as to this improvement may be found in the Annual Reports of the Chief of Engineers for 1892, page 881; for 1896, page 780; for 1897, page 1136; and further information is contained in the report for 1900, page 1505.

Maps of the river are printed in Annual Reports of the Chief of Engineers for 1885, page 760, and for 1905, page 1044.

Amount (estimated) required for completion of existing project..... $373,392.68

(*d*) *South River.*—This is a small stream in the central part of New Jersey, which discharges into the Raritan River about 8 miles above its mouth. Before improvement by the United States a private canal about three-fourths of a mile long had been dredged from near Washington, on the South River, to Sayreville, on the Raritan River, which shortened the sailing course about 2 miles.

The depth in the canal was about 3.5 feet and in the river about 2.5 feet as far as Oldbridge, at the head of navigation, 6.3 miles above the canal.

The first project for this improvement was adopted March 3, 1871, and provided for dredging a channel 6 feet deep at mean low water up to the Washington wharves, at an estimated cost of $13,653. This was completed in 1874, at a cost of $20,000.

The existing project, adopted June 14, 1880, provides for correcting the canal outlet and for obtaining, by dredging and diking, a channel 100 feet wide and 8 feet deep to Washington, 1.5 miles above the mouth; thence 6 feet deep to Bissetts, 3.7 miles above the mouth; thence 4 feet deep to Oldbridge, 6.3 miles above the mouth, at the head of navigation. The cost was estimated at $194,695, but was reduced in 1892 to $176,695. References to examinations and surveys are contained in the Annual Reports of the Chief of Engineers for 1904, page 143, and for 1907, pages 166 and 175.

The amount expended on the present project up to the close of the fiscal year ending June 30, 1909, was $115,663.84, of which $89,336 was used in carrying on the work and $26,327.84 for maintenance. About one-half of the work contemplated under the project has been completed. Below the wharves at the village of South River or Washington a channel from 50 to 75 feet wide and 8 feet deep has been dredged and the projected dikes have been built. Above Washington the improvement accomplished is shown in report of work for fiscal year of 1908.

No work was done during the fiscal year. At the close of the year contract for dredging for maintenance was in course of preparation under allotment of $5,000 from the appropriation made by the river and harbor act of March 3, 1909. Expenditures were mainly for office expenses.

The maximum draft that could be carried to South River or Washington on June 30, 1909, was about 6 feet, thence to within 340 feet of Bissetts, 5 to 6 feet at mean low water. Mean range of tides: At canal, 5.34 feet; at Oldridge, 4.57 feet.

Large brickyards established along the banks of the river give it a commercial importance out of proportion to its size.

The commerce is principally in brick, sand, clay, coal, fertilizer, and general merchandise, and amounted in 1899 to 343,202 tons; in

1901, to 328,186 tons; in 1902, to 387,246 tons; in 1903, to 333,890 tons; in 1904, to 392,626 tons; in 1905, to 260,204 tons, valued at $1,046,208; in 1906, to 226,227 tons, valued at $972,550; in 1907, to 118,549 tons, valued at $477,530; and in 1908, to 99,197 tons, valued at $472,013. Tonnage heretofore reported in gross tons; reported for this year in short tons.

The improvement has caused a great reduction in freight rates, and it appears probable that the rates will be further reduced when the improvement reaches the upper stretches of the river. From reliable information received it appears that as a result of this improvement a reduction in freight rates on fire brick by rail to Boston of from $3.25 to $2 per ton has been made. The freight rate by rail to New York is $1.60 per ton; by water it is 75 cents per ton.

It is proposed to apply amount estimated as a profitable expenditure and the available balance to continuing and maintaining the improvement in accordance with the adopted project.

Details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1896, pages 784–785.

Amount (estimated) required for completion of existing project..... $87,359.00

(*e*) *Shoal Harbor and Compton Creek.*—This harbor is on the south shore of Raritan Bay, 5 miles from Sandy Hook. Compton Creek is a narrow stream emptying into it. The natural harbor is inside the mouth of the creek, where the depth is from 3 to 6 feet at mean low tide. The creek is navigable for about 1 mile above its mouth, where it is crossed by a railroad bridge without a draw. One-fourth of a mile above its mouth it is crossed by a highway drawbridge.

The entrance to this harbor was originally obstructed by a broad flat shoal on which there was a depth of less than 1 foot at mean low tide, the distance between the deep water in the creek and the 4-foot depth in the bay being about one-half mile.

The original and existing project, adopted September 19, 1890, proposes a channel 4 feet deep connecting Compton Creek with Raritan Bay, the width to be 150 feet in the bay and 75 feet in and near the mouth of the creek, the channel through Shoal Harbor to be protected by a dike if necessary, at an estimated cost of $64,130.

The amount expended to June 30, 1909, was $45,502.81, of which sum $17,000 was applied to carrying out the project and $28,502.81 for maintenance. About three-fifths of the dredging contemplated under this project has been completed and a 4-foot channel 75 feet wide has been dredged through Shoal Harbor, connecting Raritan Bay with Compton Creek.

Nothing in furtherance of the improvement was done during the past fiscal year. The expenditure was for traveling expenses.

The maximum draft that could be carried June 30, 1908, in the improved channel through Shoal Harbor and Compton Creek to the drawbridge was 4 to 5 feet at mean low water. No soundings have been made this season. Mean range of tides, 4.5 feet.

The commerce of this locality in farm and fish products, fertilizers, and general merchandise amounted to 180,000 tons in 1901, to 48,790 tons in 1902, to 65,175 tons in 1903, to 28,570 tons in 1904, to 34,340 tons in 1805, valued at $1,198,200; in 1906 to 34.538 tons,

valued at $1,167,920; in 1907 to 62,895 tons, valued at $1,809,380; and in 1908 to 82,262 tons, valued at $1,510,210. Tonnage heretofore reported in gross tons; reported for this year in short tons.

It appears from statements received from shippers that there has been a reduction on coal freights of 40 per cent, on manure from 40 to 50 per cent, and on fish 20 per cent, as a result of this improvement, and if the improvement is not continued the rates would be very much advanced.

Amount (estimated) required for completion of existing project $47,130.00

(*f*) *Cheesequake Creek.*—This is a small stream in the eastern part of New Jersey which discharges into Raritan Bay, about 2 miles east of South Amboy. Before improvement by the United States the available navigable depth in the creek was 1½ feet at mean low water over the shoals, the distance from the entrance to the upper limit of navigation being 3½ miles.

The existing project was adopted June 14, 1880, and provided for a new outlet, 5 feet deep, from the creek into Raritan Bay, at right angles to the shore line through a beach which put across the mouth of the creek from the right bank, and which had forced the outlet nearly one-half mile to the westward. This was to be obtained by dredging and constructing parallel jetties of stone, 200 feet apart, on each side of the dredged channel; the old outlet was to be closed by a pile dike, and a channel, 4 feet deep and from 50 to 100 feet wide, was to be dredged from the mouth to the head of navigation, 3½ miles up the creek. In this distance two dikes were to be built, and a new channel to be made through the marsh was to cut off a bend in the creek. Stump Creek, a tributary stream emptying into the creek near its mouth, was to be improved by dredging a channel 50 feet wide and 3 feet deep.

The cost was estimated at $75,279, which was revised in 1885 to $90,000.

Reference to survey and estimate are noted in the Annual Report of the Chief of Engineers for 1905, page 152.

The amount expended on the present project up to the close of the fiscal year ending June 30, 1909, was $49,352.28, of which $40,000 was used in carrying out the project and $9,352.28 in maintenance. About four-ninths of the work contemplated under this project has been completed, and the work accomplished consists of the construction of the two parallel stone jetties at the mouth, the dredging of a 5-foot channel between them connecting the creek with the 5-foot curve in Raritan Bay, and the construction of the pile dike closing the old outlet.

During the fiscal year nothing in furtherance of the improvement was done; the channel has deteriorated but little since the last work in 1907.

The improvement has not advanced sufficiently to affect freight rates. It is proposed to expend the amount estimated as a profitable expenditure in continuing the work of improvement and for maintenance.

The maximum draft that could be carried through the mouth of the creek on June 30, 1909, was about 5 feet; mean range of tides, 5.1 feet.

The commerce of the creek is principally in fertilizer, sand, brick, clay, and farm produce, and amounted in 1886 to about 50,000 tons;

in 1905 to 45,500 tons, valued at $146,050; in 1906 to 83,648 tons, valued at $625,000; in 1907 to 89,500 tons, valued at $263,100; and in 1908 to 79,520 tons, valued at $209,550. Tonnage heretofore reported in gross tons; reported for this year in short tons.

Further details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1886, page 763.

Sketches of Cheesequake Creek are printed in the Annual Reports of the Chief of Engineers for 1882, page 680, and in 1905, page 1051.

Amount (estimated) required for completion of existing project	$50,000.00

CONSOLIDATED.

July 1, 1908, balance unexpended	26,797.12
Amount allotted from appropriation made by river and harbor act approved March 3, 1909	23,000.00
	49,797.12
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	23,510.70
July 1, 1909, balance unexpended	26,286.42
Amount (estimated) required for completion of existing project	596,136.68
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance exclusive of the balance unexpended July 1, 1909	[a] 188,095.00

RARITAN BAY, NEW JERSEY.

This bay is a large body of water lying between the southern end of Staten Island and the New Jersey shore. Its greatest width north and south is about 5 miles, and its greatest length east and west is about 7 miles. The Raritan River empties into it at its west end, between Perth Amboy and South Amboy, and the Arthur Kill, or Staten Island Sound, extends northward, connecting it with Newark Bay.

This bay had naturally a fairly straight channel, 11 feet deep, to South Amboy. The line of the deepest water, however, followed the Staten Island shore from Perth Amboy to Seguine Point, where it was separated from deep water in the eastern part of the bay by a shoal 1.5 miles broad, with a minimum depth of 14.5 feet.

The original and existing project, adopted March 3, 1881, and extended September 19, 1890, and June 3, 1896, provides for dredging channels 300 feet wide and 21 feet deep from Seguine Point to deep water in the bay, a distance of about 1.5 miles, through two shoals opposite Wards Point, 0.4 and 0.6 mile long, respectively, and from South Amboy to deep water near Great Beds light, a distance of about 1.5 miles. The estimated cost of the work is $507,875.

Reference to reports on examinations and surveys are noted in the Annual Report of the Chief of Engineers for 1904, pages 140 and 1158.

The amount expended on the work up to the close of the fiscal year ending June 30, 1909, was $560,954.53, of which $297,314.45 was used in carrying out the project and $263,640.08 for maintenance.

[a] At the time the estimates for the fiscal year ending June 30, 1911, were prepared and submitted to the Secretary of War no item was included for Shoal Harbor and Compton Creek. After further consideration the district engineer officer recommends an estimate of appropriation for the year 1911 of $47,130 toward completing the improvement at that locality and $10,000 for maintenance. Had these amounts been included with the others at the time when originally submitted, the total for the combined works in this consolidated item of appropriation would have been increased from $188,095 to $245,225.

Of this amount $3 was derived from the sale of maps. The project has been completed, and the only work now contemplated is maintenance of the improvement.

Operations during the fiscal year consisted in dredging under contract for maintenance. Work was in progress at the beginning of the fiscal year, and was continued until August 1, when the contract was completed. The amount of material dredged during the year was 48,936 cubic yards, making the total amount removed under the contract 105,990 cubic yards.

Project for expenditure of the allotment of $20,000, act of March 3, 1909, was approved on March 19. Examinations of the channels were made, and preparation of specifications for maintenance dredging was in progress at the close of the year.

It is proposed to apply the amount recommended as a profitable expenditure for maintenance.

The maximum draft that could be carried June 30, 1909, through the Wards Point, South Amboy, and Seguine Point channels was about 20 feet at mean low water. Mean range of tides, 5 feet.

The commerce of the bay is mainly in coal, brick, refined lead and copper, bullion, clay products, and general merchandise, and amounted in 1901 to 4,722,048 tons, in 1902 to 5,453,122 tons, in 1903 to 4,484,152 tons, in 1905 to 5,296,986 tons; in 1906 to 6,432,245 tons, valued at $114,358,610; in 1907 to 7,424,414 tons, valued at $139,228,344; and in 1908 to 8,729,748 tons, valued at $136,550,115. Tonnage heretofore reported in gross tons; reported this year in short tons.

It appears from statements of the shipping interests of the great railroad terminals that the improvements have resulted in a great reduction of towing rates and a proportionate reduction of freight rates, owing to the greater quantity of coal that can be carried and towed through these channels over that which was carried before the improvement was made.

July 1, 1908, balance unexpended	$24,787.52
Amount allotted from appropriation made by river and harbor act approved March 3, 1909	20,000.00
	44,787.52
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	23,239.05
July 1, 1909, balance unexpended	21,548.47
July 1, 1909, outstanding liabilities	4.80
July 1, 1909, balance available	21,543.67
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	40,000.00

ALLOWAY CREEK, NEW JERSEY.

This is a tidal tributary of the Delaware River, flowing westerly in the southwestern part of New Jersey, its mouth being about 50 miles below Camden, N. J. In its original condition the creek was obstructed between its mouth and Quinton, a distance of about 10 miles, by shoal areas in the upper half of the stream, which reduced the low-water depths to from 1.3 to 4 feet. The mean range of tide is 6 feet at the mouth and 4 feet at Quinton, the head of navigation.

The original project of 1889 proposed the formation by dredging of a channel 6 feet deep at mean low water and 60 feet wide from

Quinton to a point about 1,000 feet above upper Hancock Bridge; thence a channel of the same depth and 75 feet wide to a locality known as the "Square," where the work was to be supplemented by a dike. At a locality known as the "Canal," in addition to a channel of the last-named dimensions, the width of the stream was to be increased to about 150 feet between its low-water lines. The project was modified on December 10, 1896, so as to provide for a dike formed by a single row of piles above upper Hancock Bridge. This modification did not increase the originally estimated cost of the work, which is $25,000.

Channels from 40 to 75 feet wide and 6 feet deep at mean low water have been dredged at various localities, and dikes 300 and 404 feet in length, respectively, have been constructed at the "Square" and above upper Hancock Bridge. The channel has been dredged not less than 75 feet wide and 6 feet deep from the mouth to a point one-half mile below Hancock Bridge, and thence 60 feet wide and 6 feet deep to the upper end of a shoal just above Hancock Bridge, a distance of 4.92 miles. This work extended to January, 1908.

The river and harbor act of March 2, 1907, appropriated $5,000 for continuing improvement and maintenance, and authorized a sufficient amount thereof to be applied to the construction of a cut-off at Fosters Bottle, with the proviso that no expenditure should be made thereon until all land needed for such cut-off should be deeded to the United States free of expense. During the past fiscal year this title was obtained, and under a contract the cut-off at Fosters Bottle was made, and resulted in a straight channel through it of a minimum depth of 7 feet at mean low water and a bottom width of at least 75 feet, 1 foot overdepth and side slopes having been allowed in accordance with the contract. This completed the contract.

The amount expended on the improvement to June 30, 1909, is $28,875.84, of which $7,478.11 was for maintenance.

The maximum draft that could be carried on June 30, 1909, to Quinton was 4½ feet.

The commerce of the creek consists of miscellaneous articles, such as coal, sand, lumber, agricultural products, etc. The tonnage for the calendar year 1908 was 18,490, valued at $658,125.

The freight rates are reported to have been lowered by reason of the improvement of the creek, but to what extent is not stated. Larger boats are enabled to enter and depart, and shipments have been facilitated very much by avoiding delays in waiting for tides.

It is proposed to expend the funds recommended below in maintenance of the improvement by dredging, which will extend the benefits of the improvement.

July 1, 1908, balance unexpended	$5,032.87
Received from sales	100.00
	5,132.87
June 30, 1909, amount expended during fiscal year for works of improvement	4,908.71
July 1, 1909, balance unexpended	[a] 224.16
Amount (estimated) required for completion of existing project	200.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	7,000.00

[a] In addition to this balance the sum of $5,000 is made available by the river and harbor act of March 3, 1909, but not yet allotted.

COOPER CREEK, NEW JERSEY.

This creek enters the Delaware River in the city of Camden, just above Cooper Point. It was navigable at mean high water for a distance of 9 miles from its mouth for vessels drawing 5 feet, and for the first 5 miles for vessels of 11½ feet draft. The mean range of the tide at the mouth is about 6 feet. For a distance of 1½ miles from the mouth the width of the stream averaged about 80 feet at low water and about 120 feet between the banks, and the channel in its original condition had a depth at mean high water of from 12 to 15 feet, except at one place where the depth was 9½ feet.

The project for this improvement was adopted in the river and harbor act of June 3, 1896, and is printed in the Annual Report of the Chief of Engineers for 1895, page 1102. It provides for the formation, by dredging, of a channel 70 feet wide at bottom and 18 feet deep at mean high water from the mouth of the creek to Browning's Chemical Works and a channel of the same dimensions through the bar just outside the mouth—in all, a distance of about 9,000 feet. The estimated cost, including contingencies, is $35,000.

The river and harbor act of June 3, 1896, appropriated $37,000 for completing this improvement, of which $2,500, or as much thereof as might be necessary, was to be expended in rebuilding the dike on the government reservation in the Delaware River at Woodbury Creek.

The sum of $2,500 was expended in rebuilding the dike at Woodbury Creek referred to and the channel in Cooper Creek was dredged. This dredging resulted in the formation of a channel extending from the mouth to the Camden Iron Works, 7,500 feet long, 50 to 70 feet wide, except at the bridges, where the widths are 30 feet, and 18 feet deep at mean high water (12 feet at mean low water). At State street the depth made was only 14 to 15 feet on account of a city water main crossing the stream at that depth. Further operations were suspended to await the lowering of this pipe by the city.

In 1906, to meet the wants of the traffic in the creek, the channel was dredged between the State Street Bridge and the 12-foot contour in Delaware River to a depth of 12 feet at mean low water and a width of 70 feet.

The water pipe at State street was lowered in September, 1907, but no work has been done on the improvement since for want of sufficient funds. The expenditure during the year was for examination and supervision expenses.

About 65 per cent of the projected work is completed.

Under date of April 21, 1909, the Chief of Engineers allotted $5,000 from the appropriation made by the river and harbor act of March 3, 1909, for preservation and maintenance of river and harbor works, and approved project for expenditure of available funds, and bids for the dredging to be done thereunder will soon be opened.

The maximum drafts that could be carried on June 30, 1909, at mean low water were 12 feet from the Delaware River to the Federal Street Bridge, thence 9½ feet to Camden Iron Works, and thence 6½ feet to Browning's Chemical Works. The stream is navigable nearly to Medford Branch of Pennsylvania Railroad, a distance of 9 miles.

The expenditure during the year was for examination and supervision expenses.

The amount expended to June 30, 1909, is $31,058.90, exclusive of the $2,500 expended in rebuilding dike at Woodbury Creek. Of this amount $5,382.80 was for maintenance.

The commerce for the calendar year 1908, reported by the Camden Board of Trade, was 221,205 tons, valued at $1,807,633.

The effect of the improvement made in this stream on freight rates has been to reduce them by permitting larger vessels to be secured for long voyages than was formerly possible. The railroad rates to points in the United States east of Cape Cod are 25 per cent higher than by water.

It is proposed to expend the funds recommended below to complete the project dimensions of the channel above the State Street Bridge and to maintain the improvement by dredging. This will extend the benefits of the improvement.

July 1, 1908, balance unexpended	$3,499.32
Amount allotted from appropriation made by river and harbor act approved March 3, 1909	5,000.00
Received from sales	100.00
	8,599.32
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	58.22
July 1, 1909, balance unexpended	8,541.10
Amount (estimated) required for completion of existing project	5,131.18
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	11,000.00

MANTUA CREEK, NEW JERSEY.

Mantua Creek is a stram flowing into the Delaware River at a point about 10 miles below the terminal and ferry of the Pennsylvania Railroad at Camden, N. J.

In its original condition it was navigable at high water for a distance of one-half mile above its mouth to the phosphate works of the I. P. Thomas & Sons Company for vessels of 13 feet draft; thence 3½ miles farther, to Paulsboro, for vessels drawing 9 feet; thence 3½ miles to Parkers Landing for tugs and barges drawing 6 feet, this being the head of steam navigation; thence 4.1 miles to Mantua, 11¼ miles above the mouth, small boats and barges of 3 to 4 feet draft passed up on the tide. The navigable portion is generally bordered by low ground, protected from overflow by earthen banks. The general course of the stream is tortuous, and its navigation was much obstructed by bars, sharp bends, and the upper portion by stumps and overhanging trees. The stream, on account of its flat watershed, is subject to only moderate freshets, which seldom exceed 2 to 3 feet above tide water. The range of tide is 6 feet at the mouth, 4.5 feet at Paulsboro, 3.4 feet at Berkley, and 2 feet at Mantua, which is the head of navigation. The low-water width near the mouth averaged 160 feet, decreasing to about 100 feet at Paulsboro. Above Paulsboro the width decreased to 88 feet at Parkers Landing, and near Mantua to 50 feet.

The approved project for the improvement, which was adopted by Congress in river and harbor act of March 3, 1899, contemplates the dredging of a channel 100 feet wide on the bottom and 12 feet deep

from the 12-foot contour in the Delaware River, through the marsh to the phosphate works, a distance of 2,200 feet; thence 80 feet wide on the bottom and 8 feet deep to Paulsboro, 6,300 feet, making a channel nearly direct by cutting off three bends; thence to Parkers Landing, near Berkley, 3 miles, with one cut-off 60 feet wide and 7 feet deep; and the dredging of a cut-off 350 feet long, 50 feet wide, and 3 feet deep, 9,000 feet above Berkley; also the removal of overhanging trees above Berkley and the construction of jetties on both sides at the mouth of the creek. The estimated cost of this improvement is $145,030. Such lands and rights as were considered necessary for the cut-offs were purchased in September, 1900, at a cost of $8,000.

Between 1901 and 1905 the channel between the phosphate works and Paulsboro was dredged to the project dimensions and the three cut-offs made as planned, and a channel 12 feet deep at mean low water dredged direct from the 12-foot contour in the Delaware River to the phosphate works, cutting off the old mouth, the width made being 110 feet across the flats and 100 feet at the upper and lower ends of the dredging.

For the protection of the channel at the mouth a jetty 754 feet in length was constructed in 1907, on the east side of the channel, and a jetty 579.5 feet on the west side, and a dike, 524 feet long, to close the old mouth of the river.

During the fiscal year 1909 the channel was dredged to a depth of 13 feet at mean low water and a width of 100 feet from the 12-foot curve in the Delaware River to the upper end af the I. P. Thomas & Sons' fertilizer works, thence 9 feet deep and 80 feet wide to the highway bridge at Paulsboro, and thence a distance of 12,000 feet 8 feet deep and 60 feet wide, these depths including 1 foot for overdepth allowed under the contract. The portion of this work below the Paulsboro highway bridge was maintenance work.

About 55 per cent of the projected work has been done.

The amount expended on the improvement to June 30, 1909, is $96,707,35, of which $93,707.35 is on the present project, and of this latter $7,203.18 was for maintenance.

The maximum drafts that could be carried on June 30, 1909, at mean low water over the part of the creek under improvement are 12 feet to the phosphate works, thence 8 feet to Paulsboro, and thence, for 12,000 feet, 7 feet. The stream is navigable for small craft for about one-half mile above Mantua.

It has been impracticable to obtain commercial statistics for the entire river, but the receipts by water at Mantua during the calendar year 1908 were 35,250 tons, valued at $214,225. This is but a small fraction of the entire traffic.

The river and harbor act of March 3, 1909, provided for a preliminary examination and survey of Mantua Creek, "with a view to continuing improvement to the head of navigation," and the survey is now in progress.

It is proposed to expend the funds recommended below on the construction of the project channel above Paulsboro and on the maintenance of the improvement below Paulsboro by dredging and jetty repairs. This will extend the availability of the stream for navigation.

July 1, 1908, balance unexpended		$13,167.16
Received from sales		100.00
		13,267.16
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$5,221.33	
For maintenance of improvement	7,203.18	
		12,424.51
July 1, 1909, balance unexpended		842.65
Amount (estimated) required for completion of existing project		57,783.18
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		31,000.00

MAURICE RIVER, NEW JERSEY.

Report on a survey is printed in House Document No. 664, Fifty-ninth Congress, first session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., March 19, 1906.

Respectfully returned to the Chief of Engineers, U. S. Army.

From a study of the history of work undertaken by the United States for the benefit of navigation on Maurice River, New Jersey, it appears that this river has been under improvement since 1885, when operations were commenced under a project, approved in 1882, providing for a channel 100 feet wide, 6 feet deep at mean low water through the 4 miles of river below Millville bridge, and 4 feet deep along the wharves of the city. A modification of the project, made in 1890, contemplated carrying the 6-foot depth to the upper limits of the project, and one made in 1892 provided for extending this depth for a farther distance of 500 feet with a width of 50 feet. The estimated cost of the work was $112,000, but it was completed in 1892 at a total expenditure of $43,000.

In 1900 a survey of the river was made and a project presented for obtaining a channel 7 feet in depth, 75 and 100 feet in width, diminishing in the upper stretch to 6 feet depth and 60 feet width. This project provided for considerable revetment of the dredged channel, but like the earlier project, excluded proposed work for improving the mouth of the river on account of its excessive cost. No appropriations have been made for this work and none has been made for the maintenance of the improvement since the act of September 19, 1890. As a consequence the low-water channel has shoaled in places to a depth of about 2½ feet.

The within report presents a plan for constructing in the upper river, from Frenchs bar to Millville, a channel 7 feet in depth at mean low water, having a bottom width of 100 feet, diminishing to 60 feet in the upper reach. It also provides for a turning basin at Millville and for dredging a cut 7 feet deep and 100 feet wide across the bar at the mouth of the river, thus affording a continuous channel of 7 feet depth from Delaware Bay to Millville, the proposed depth and width being exceeded by the natural channel from the mouth of the river to Frenchs bar. The estimated cost of the work is $156,200, and its maintenance $5,000 per annum.

The prosecution of work under the former adopted project was immediately beneficial by permitting larger vessels to reach Millville. Statistics of commerce are given in the annual reports of the Chief of Engineers, as follows:

Year.	Tons.	Value.
1889	115,976	$973,525
1890	169,100	1,471,000
1891	235,380	2,404,662

Notwithstanding the fact that the channel has seriously deteriorated in recent years, a water-borne commerce amounting to 104,008 tons is reported for the past year. The total freight movement at Millville during the same period amounted to 509,101 tons,

valued at $11,914,982. An improved water route would probably divert a considerable tonnage of freight from existing land transportation lines.

After careful consideration of the present and prospective commerce of Maurice River the Board has reached the conclusion, agreeing with the district officer and division engineer, that the expenditure of $156,200, together with $5,000 annually thereafter for maintenance, in the further improvement of this river is justified by the public interests involved, and that it is desirable for the United States to undertake this work in accordance with the plan outlined within.

OLDMANS CREEK, NEW JERSEY.

Report on a recent survey is printed in House Document No. 1083, Sixtieth Congress, second session. The report of the Board of Engineers, in which the Chief of Engineers concurs, is as follows:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., October 26, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

As stated in the Board's indorsement of August 26, 1907, on the district officer's report of preliminary examination of Oldmans Creek, the Board held a public hearing at Pedricktown, N. J., and made a personal inspection of the creek from its mouth to Auburn, the results of which convinced it "that considerable benefit would result to the people of this community if better navigation facilities were provided, and that a moderate expenditure of government funds for this purpose is justified, provided it is found from a survey that a reasonably stable channel can be obtained and maintained at moderate cost."

A survey of the stream having now been made by the district officer, he proposes a plan of improvement providing for a channel 100 feet wide and 6 feet deep across the bar at the mouth, with one jetty to maintain it; a channel 75 feet wide and 6 feet deep thence to Pedricktown, and a channel 40 feet wide and 5 feet deep from Pedricktown to Auburn, with nine cut-offs, not including that involved in constructing the new entrance. The cost of this improvement is estimated at $89,500. To provide the improvement outlined as far as Pedricktown only is estimated to cost $66,200. These estimates could be somewhat reduced by the elimination of the proposed cut-offs, but the Board concurs with the district officer in the opinion that the benefits to be derived from the shorter and more cheaply maintained route by way of the cut-offs more than outweigh the difference in the required expenditure.

The commercial conditions at this locality were discussed in the report on preliminary examination, in the Board's indorsement reviewing the same, and in the within report on the survey. In brief, the territory tributary to Oldmans Creek is exceedingly fertile and produces a large amount of perishable produce, such as tomatoes, melons, berries, fruits, etc., which require quick and reliable transportation at reasonable rates. It appears that the railroads have not been able to furnish such transportation, and that the crops are of such character that they can not in all cases be taken either to the railroad or to other waterways. The Board is of the opinion that the benefits to be expected from an improvement of the stream to Auburn are of such extent and character as will justify the United States in undertaking the improvement. It therefore recommends approval of the project proposed by the district officer at a cost of $89,500, and $2,500 per annum for maintenance, with the provision that the rights of way for the cut-offs be deeded free of cost to the United States and the Government released from all claims for damages arising from the proposed diversion of the stream. As the greatest production of this locality is in the vicinity of Auburn, the Board does not favor the lesser project, which provides for a channel to Pedricktown only, believing that the benefits to accrue therefrom would not justify the expenditure.

RACCOON CREEK, NEW JERSEY.

This creek rises in Gloucester County, flows in a northwesterly direction, and empties into the Delaware River at a point nearly opposite Marcushook, Pa. A preliminary examination and survey of Raccoon Creek was made in 1899, and a report, with estimated cost of improvement, is printed in Annual Report of the Chief of Engineers for 1900, pages 1590–1598.

It was navigable at high water for a distance of 1¾ miles above its mouth to Bridgeport for vessels of 9 feet draft, thence 3¼ miles farther to Springer's wharf for vessels drawing 7 feet, and thence 4¾ miles to Swedesboro, the head of steam navigation for boats and barges having a draft of 4 feet. Above Swedesboro the stream was narrow, shoal, and very crooked. The navigable portion, when it left fast land, wound through meadows lying 2 or 3 feet above low water, which, except for the 2 miles immediately below Swedesboro, were generally protected from overflow by revetted earthen banks. Navigation was much obstructed by bars and a few sharp bends.

The range of tide varies from 6 feet at the confluence with the Delaware River to 4.9 feet at Swedesboro, where it is considerably influenced by winds and freshets.

The approved project, adopted by river and harbor act of June 13, 1902, proposes the formation of a dredged channel 7 feet deep and 75 feet in width at mean low water from the mouth for a distance of 1¾ miles to Bridgeport, thence a channel of the same depth and 60 feet wide to Springer's wharf, and thence a channel 5 feet deep at mean low water and 40 feet in width to the head of navigation at Swedesboro, 9¾ miles from its mouth, together with the widening of the channel around sharp bends, at an estimated cost of $102,135.

Between 1903 and 1906 a continuous channel was dredged to the project dimensions from the mouth to the highway bridge at Swedesboro, except widening at bends and the construction of the cut-off at Molonox shoal.

The river and harbor act of March 2, 1907, appropriated $15,000 for continuing the improvement and for maintenance, and authorized a sufficient amount thereof to be applied to the making of a cut-off at Molonox shoal, with proviso that no expenditure should be made thereon until the land needed therefor should have been deeded to the United States free of expense. This title has been acquired and contract entered into for making the cut-off. Work under this contract was begun on May 13, 1909, and to the end of the fiscal year a length of 3,370 feet of channel had been completed. The maintenance expenses were for supervision and examination.

The amount expended on the improvement to June 30, 1909, is $26,271.30, of which $3,246.76 was for maintenance. Of the former amount $25,514.07 was on the present project.

The maximum drafts that could be carried on June 30, 1909, at mean low water were 7 feet from the Delaware River to Bridgeport, 6 feet to Springer's, and 4 feet thence to Swedesboro.

The improvement of the stream has so far had no marked effect upon freight rates. Perishable freight is now expeditiously carried and bulky freight by water costs only about half that by rail. The execution of the work has altered the stream by increasing the tidal range in the upper waters about 1 foot, and therefore, to effect the provisions of the project, it is necessary to do additional dredging to secure the low-water depth contemplated. About one-half of the projected work has been done.

The commerce of the creek during the calendar year 1908, as reported, was 92,268 tons, valued at $879,150.

It is proposed to expend the funds recommended below in obtaining the project depth on the new mean low-water level, in widening the bends, and in maintenance; all in extension of benefits to navigation.

July 1, 1908, balance unexpended		$23,941.69
Received from sales		100.00
		24,041.69
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$2,021.66	
For maintenance of improvement	191.33	
		2,212.99
July 1, 1909, balance unexpended		21,828.70
July 1, 1909, outstanding liabilities		1,980.00
July 1, 1909, balance available		19,848.70
July 1, 1909, amount covered by uncompleted contracts		14,700.00
Amount (estimated) required for completion of existing project		57,326.33
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		15,000.00

SALEM RIVER, NEW JERSEY.

In 1872 the upper part of this river was separated from the lower part by a dam and was connected with the Delaware River by a canal forming two independent streams with mouths about 10 miles apart.

Prior to the adoption of the present project $17,209.34 had been expended on improvement of this stream, of which $10,000 was applied to work in Salem Cove, at the natural mouth below Salem, with which a channel 8 feet deep and 100 feet wide at low water was obtained, and $7,209.34 to improvement of the upper river in the formation of a channel 6 feet deep and 50 feet wide at mean low water up to Hoxies Landing.

Report of survey on which the present project is based is printed in the Annual Report of the Chief of Engineers for 1897, page 1245, and report thereon by the Board of Engineers for Rivers and Harbors is printed in River and Harbor Committee Document No. 12, Fifty-ninth Congress, second session.

The existing project was adopted by the river and harbor act of March 2, 1907, which appropriated $29,000 for completion of the improvement. It provides for dredging the lower river below Salem 100 feet wide and 9 feet deep at mean low water, amplifying at the bends so as to permit the passage of vessels 200 feet long from Delaware River up to the highway bridge over Little Salem Creek, including the removal of the stony bars in front of the city wharves and at the bend above the brickyard. The estimated cost of this work, as given by the Board of Engineers for Rivers and Harbors in report of January 16, 1907, is $29,000, subsequently increased to $38,600.

After an examination of the channel proposals were invited in July, 1907, for the required dredging, but as only one bid was received, at 27.5 cents per cubic yard, which was considered excessive, it was rejected. Proposals were again opened in May, 1908, under more favorable conditions, the lowest bid received this time being 19.9 cents per cubic yard.

In the examination above referred to it was found that the amount of material to be excavated to obtain the project channel dimensions, with an allowance of 1 foot for overdepth dredging, would be con-

siderably in excess of that given in the report of survey of 1897, and, upon recommendation of the Chief of Engineers, the Secretary of War, in accordance with section 2 of the river and harbor act of March 2, 1907, authorized the expenditure of the available funds to the excavation of a channel of such dimensions as could be secured thereby.

Accordingly a contract for dredging was entered into and completed April 30, 1909. The channel was dredged to a depth of 10 feet, including 1 foot for overdepth made under the contract, and a width of 100 feet from the 9-foot curve in the Delaware River to the 9-foot depth in Salem River, a distance of 7,350 feet; and from the lower part of Little Salem River to the Covered Bridge, a stationary structure, a distance of 2,920 feet, the channel was dredged to a depth of 9 feet at mean low water and a width of 75 feet, resulting in a channel 9 feet deep at mean low water from the Delaware River to the Covered Bridge, the head of navigation at Salem, a distance of about 4½ miles, the width being 100 feet in the Delaware River to inside the mouth of Salem River, widening to 200 feet at the beacon, and thence 75 feet to Salem. The maintenance expense was for examination and supervision.

About 80 per cent of the projected work has been done.

The maximum draft that could be carried on June 30, 1909, at mean low water over the part of the river under improvement between Salem and the Delaware River was 9 feet, the rise and fall of tide being 6 feet.

The amount expended on the improvement to June 30, 1909, is $45,273.89, of which $28,064.55 is on the present project, of which $357.22 was for maintenance.

The commerce for the calendar year 1908 was 121,658 tons, valued at $3,063,051. The effect of the improvement on freight rates has not been reported, but it has facilitated and expedited shipments of fruits and other perishable merchandise.

In view of the fact that the approved project can not be completed with the funds appropriated on the original estimate for completion, recommendation is made below for an additional appropriation of $9,957.22 to complete the project, and for the necessary funds to maintain the channel, all of which will extend the benefits resulting.

July 1, 1908, balance unexpended		$28,063.11
Received from sales		100.00
		28,163.11
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$26,770.44	
For maintenance of improvement	357.22	
		27,127.66
July 1, 1909, balance unexpended		[a] 1,035.45
July 1, 1909, outstanding liabilities		13.20
July 1, 1909, balance available		1,022.25
Amount (estimated) required for completion of existing project		9,957.22
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		14,600.00

[a] In addition to this balance the sum of $5,000 is made available by the river and harbor act of March 3, 1909, but not yet allotted.

SHREWSBURY RIVER, NEW JERSEY.

This river is a large tidal basin in the eastern part of New Jersey, and consists of two bays, each having an area of about 3 square miles, and known, respectively, as the North Branch (or Navesink River) and the South Branch, and a channel called the main stem, which unites the two branches at their eastern ends and extends northwardly to the outlet at southeast end of Sandy Hook Bay. The river is navigable on the North Branch to Red Bank, 8 miles from the mouth, where it is crossed by three bridges without draws, and on the South Branch to Branchport, 9 miles from the mouth; also to Little Silver, Oceanport, Parkers Creek, North Long Branch, and Monmouth Beach, on the several arms of the South Branch.

The part of the river which has been under improvement by the United States consists of the main stem, the North Branch to Oceanic, 5 miles from the mouth, and the South Branch to the vicinity of Seabright, about 5½ miles from the mouth. The bays above Oceanic and Seabright had sufficient water to accommodate navigation.

Before any improvement was begun by the United States the available depth to Oceanic, on the North Branch, was 3½ feet, and to Seabright, on the South Branch, it was 2½ feet; the depth in the main stem was 4 feet. For details see Annual Report of the Chief of Engineers for 1886, page 756.

By act of Congress of August 30, 1852, $1,500 was appropriated for and expended upon a survey to ascertain the extent of a break through the beach between the Shrewsbury River and the ocean, but no work of improvement was begun.

First project: By act of Congress of July 11, 1870, a survey of the river was ordered. The report on this survey described a bar across the river nearly opposite the Navesink lights and four smaller bars above, and recommended deepening them by dredging, at an estimated cost of $14,000. The work was completed under appropriations amounting to $19,000, made in 1871 and 1873, and a new shoal near Lower Rocky Point was also dredged. The dredged channels did not long maintain the improved depth (6 feet at low tide).

Existing project, with modifications: The river and harbor act of 1875 provided for a survey of the "North and South branches of the Shrewsbury River, New Jersey." The project provided for dredging at Upper and Lower Rocky Point and a training dike at the entrance to the North Branch, at a total estimated cost of $18,000. This sum was appropriated by the river and harbor act of 1878, but before beginning the work it was decided to make a new and more detailed survey of the river. This survey was made in 1878, and the report presented a plan for improving both branches of the river and main stem to obtain a channel of 6 feet depth at mean low water, with a width of 300 feet in the main stem and of 150 feet in each of the branches, by dredging and constructing pile dikes or training walls. At this time the available depth in the main stem was found to be 5.4 feet at mean low water, in the North Branch 3.5 feet, and in the South Branch, at the entrance, 2.6 feet, practically suspending all navigation in the latter channel. The plan was referred to a Board of Engineers, and with slight modifications was approved by it February 12, 1879. It provided for the construction of seven pile dikes and for dredging at seven different shoal points, at a total estimated cost of $142,086. This project was adopted March 3, 1879. No

essential modification of this project has since been made. Nine dikes have been built and the shoals have been dredged and redredged frequently in order to maintain the proposed depth of 6 feet. Owing to the change in diking and to the cost of dredging being generally greater than originally estimated, it was found necessary in 1881, 1883, and 1887 to add to the estimate for the completion of the whole work. The existing project for improvement, therefore, is the project of 1879, with the modifications indicated above, and proposes to secure a channel of 6 feet depth at mean low water, with width of 300 feet up to the junction of the North and South branches and with a width of 150 feet in those branches, by means of dredging and diking, at an estimated cost (including appropriation of 1878 applied to this project) of $234,062.

The sum expended under the existing project to the close of the fiscal year ending June 30, 1909, was $358,166.08, of which $195,393.95 was for carrying out the project, $157,772.13 for maintenance, and $5,000 for the survey made in 1903. Of the total amount expended, $1.25 was derived from sale of a map. The project is completed, dredging and dike repairs being required for maintenance of channels. Operations during the fiscal year consisted in dredging under contract for maintenance. The amount of material removed during the year was 36,404 cubic yards. At the close of work October 13, 1908, the channels had been practically restored to projected dimensions.

The maximum draft that could be carried June 30, 1909, throughout the limits of the improvement was 5 to 6 feet at mean low water. Mean range of tides: Outer bar, 5 feet; Highlands bridge, 3 feet; Seabright bridge, 1.3 feet.

The commerce of the river, mainly in coal, farm products, fertilizer, and general merchandise, amounted in 1889 to 906,000 tons; in 1902 to 657,000 tons; in 1903 to 761,000 tons; in 1904 to 780,290 tons; in 1905 to 1,768,500 tons, valued at $8,215,000; in 1906 to 1,668,500 tons, valued at $7,235,000; in 1907 to 1,718,125 tons, valued at $6,629,750; and in 1908 to 1,854,160 tons, valued at $6,270,000. Tonnage reported heretofore in gross tons; reported this year in short tons. The passenger traffic is important, the number of people carried by the Patten Line, South Branch, in 1902 being 264,635; in 1903, 277,257; in 1904, 266,157, and in 1905, 310,367.

It is proposed to apply the amount recommended as a profitable expenditure to maintenance of the improvement in accordance with the project.

It appears from reports received from the Merchants Steamboat Company and the New York and Long Branch Steamboat Company that freight rates have been lowered, and maintained, as results of the improvement by the United States; also that the commerce has increased, and that the improvement tends to keep the freight rates down.

July 1, 1908, balance unexpended	$14,932.71
Amount allotted from appropriation made by river and harbor act approved March 3, 1909	20,000.00
Received from sale of maps during the year	6.00
	34,938.71
June 30, 1909, amount expended during fiscal year for maintenance of improvement	14,097.54
July 1, 1909, balance unexpended	20,841.17
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	20,000.00

TOMS RIVER, NEW JERSEY.

Toms River is a tributary of Barnegat Bay and enters the bay on its western shore about 11 miles above Barnegat Inlet. The source of Toms River is about 34 miles to the northwest of its mouth. The tidal flow in the river is small, but there is a large fresh-water flow from a considerable drainage basin. The town of Toms River is about 5 miles above the mouth and is the most considerable town upon it. Island Heights, a summer resort, is located on the left bank about 1 mile above the mouth.

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 346, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., November 4, 1907.

Respectfully returned to the Chief of Engineers, U. S. Army.

In the within report the district officer submits estimates for channels of 75 and 100 feet in width, and of the specified depth of 5 feet, amounting to $8,650 and $10,050, respectively, with corresponding estimates for maintenance of $900 and $1,000. He believes that the increased facilities afforded by a channel 100 feet wide more than offset the difference in original cost and cost of maintenance of such a channel as compared with one 75 feet wide, and he recommends the adoption of the 100-foot project. In this recommendation the division engineer concurs.

From statistics furnished in the report on preliminary examination it appears that the commercial growth of this stream has been retarded by the lack of a suitable navigable channel. It is stated that two railroads carry to and from Toms River annually from 15,000 to 20,000 tons of freight, much of which, it is expected, would be shipped by water if the channel permitted.

In the opinion of the Board the estimated cost of providing a channel 100 feet in width is reasonable when compared with the probable resulting benefits to navigation, and it recommends, therefore, the adoption of the project proposed by the district officer at an initial cost of $10,050, and $1,000 annually thereafter for maintenance.

TUCKERTON CREEK, NEW JERSEY.

This is a tidal stream flowing into Little Egg Harbor, on the Atlantic coast, northeast of Atlantic City. A preliminary examination and survey of the creek were made, and a report recommending its improvement is printed in Annual Report of the Chief of Engineers for 1900, pages 1612–1615.

The original low-water depth at Tuckerton, the head of navigation, was 15 inches, which increased gradually to 4 feet at the mouth of the creek, a distance of 2 miles. From the mouth of the creek across the flats to Gaunts Point, seven-eighths of a mile, the low-water depths were 2 to 2½ feet. The mean tidal range is 2½ feet.

The existing project, adopted by the river and harbor act of June 13, 1902, contemplates the dredging of a channel 6 feet deep at mean low water and 80 feet wide from Gaunts Point, seven-eighths of a mile, to the mouth of the creek; thence a channel of the same depth and 75 feet wide, 1 mile, to Parkers Landing; thence a channel of the same depth and 60 feet wide, five-eighths of a mile farther, to West Tuckerton Landing; thence a channel 5 feet deep at mean low water and 60 feet wide for three-eighths of a mile to just above Scow Landing, and thence a channel 3 feet deep at mean low water and 40 feet wide for one-eighth of a mile to the milldam at Tuckerton, together with the widening of the channel at sharp bends; the channel across the cove between the mouth of the creek and Oyster Bed Point to

be supplemented, if necessary, by a revetment wall along its northern side. The estimated cost of the work, including contingencies, is $61,380. Under authority contained in the river and harbor act of March 3, 1905, the Secretary of War authorized the location of the channel at the mouth to be changed so as to lead it in a south-southeast direction directly to the deep water at the head of Marchelder channel instead of to Gaunts Point.

The channel has been dredged to the project widths from the mouth of the river to a point 2,100 feet below the milldam at Tuckerton, the depth made being 6 feet at mean low water, except the upper 581 feet, which was dredged to 5 feet at mean low water. This completed about one-half of the project.

The river and harbor act of March 2, 1907, appropriated $12,000 for continuing the improvement, and a project for the expenditure of the appropriation was duly approved by the Chief of Engineers. This included dredging of the cut from the mouth of Tuckerton Creek to the Marchelder channel. It was then found, however, that dredging along that line would destroy several oyster beds held and owned by private parties under leases from the State of New Jersey, and it was therefore concluded to defer operations until this matter could be adjusted.

Under date of December 16, 1907, the chief of the bureau of shell fisheries of the State of New Jersey advised this department that all objection to the proposed dredging had been removed, and thereupon contract for the dredging was entered into. The contract provided for dredging a straight channel from deep water of Marchelder channel, off Parkers Island, across the flats of Little Egg Harbor to the mouth of Tuckerton Creek, passing through the point on the southwest side of the mouth, and then dredging, as far as the available funds would permit, the upper river, the depths to be 5 feet at mean low water from Marchelder channel to Scow Landing, and thence 3 feet to the milldam.

The contractor's plant arrived at the lower end of Marchelder channel on June 19, 1908, and to the end of July only 1,048 cubic yards of material had been dredged, and no work was done thereafter. On September 10, 1908, the contract was annulled. New proposals for the dredging were opened October 30, 1908, but as the prices bid were excessive the bids were rejected.

The river and harbor act of March 3, 1909, provided $2,000 for maintenance of this improvement, and proposals were then invited for dredging with the entire amount available, but no bid was received. Proposals were again invited upon revised specifications, and these are to be opened July 8, 1909.

The maximum drafts that could be carried on June 30, 1909, at mean low water over the locality of the improvement were 2 feet from the milldam to Scow Landing, 4 feet thence to West Tuckerton, 5½ feet thence to Parkers, 6 feet thence to the mouth, and thence 2½ feet to the head of Marchelder channel.

The amount expended on the improvement to June 30, 1909, is $24,846.43, of which $2,215.15 was for maintenance.

The commerce reported for the calendar year 1908 is 26,609 tons, valued at $1,192,898.

The improvement of Tuckerton Creek is not yet sufficiently advanced to show any material decrease in freight rates. Shipments

from distant points have, however, been increased and facilitated, although lumber-laden vessels still are obliged to await tides at the flats at the mouth of the creek.

As the project progresses it is believed that cost of maintenance will decrease.

It is contemplated to expend the funds recommended below in dredging for restoring and maintaining the present channel and in completing the work under the approved project to render the improvement available.

July 1, 1909, balance available	$13,034.76
Amount (estimated) required for completion of existing project	27,380.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	31,380.00

WOODBRIDGE CREEK, NEW JERSEY.

This creek is a small, crooked tidal stream, about 5 miles long, running through flat marshes for most of its length and emptying into the west side of Arthur Kill, or Staten Island Sound, 2 miles north of Perth Amboy, N. J.

It is navigable for 2¾ miles above the mouth to a point where it is crossed by a highway bridge without a draw. The width of the creek below this bridge is about 100 feet. In its original condition this stream was obstructed at its mouth by a bar having a least depth of 9.8 feet at high water, and by two shoals just inside the mouth. From these shoals a good 12-foot channel existed to above Anderson's brickworks, seven-eighths of a mile from the mouth, above which point, however, many shoals occurred, although a narrow 8-foot channel existed as far as Salamander dock, 1¼ miles from the mouth.

First project: A survey of the navigable part of this creek was made in 1878, reference to which is made on page 139 of the Annual Report of the Chief of Engineers for 1904, and a project for its improvement was adopted by the river and harbor act of March 3, 1879. This project provided for forming a channel 12 feet deep at mean high water and 80 feet wide from the mouth of the creek to the Salamander dock at an estimated cost of $13,800, which amount was increased in 1884 to $29,000. Work on this improvement was carried on under appropriations made from 1879 to 1882, amounting to $19,000, which was expended without completing the project, and was suspended in 1883, and in 1900 the channel had relapsed to its original condition.

The existing project, adopted by the river and harbor act of June 13, 1902, contemplates obtaining a channel 8 feet deep at mean low water, with a bottom width of 50 feet, by dredging, from Arthur Kill to Salamander dock, at an estimated cost of $35,000 for the improvement and $3,000 annually for maintenance. Reference to this project, and of the examination and survey upon which it is based, is contained in the Annual Report of the Chief of Engineers for 1904, page 139.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1909, was $42,329.64, of which $30,822.70 was used in carrying out the project and $11,506.94 for

maintenance. No work was done during the fiscal year. Project for the expenditure of the allotment of $6,000 for maintenance, act of March 3, 1909, was approved March 19. The work was advertised, and proposals were opened on June 8. A contract for dredging was in course of preparation at the close of the year. At the close of the last work, January, 1908, the channel was practically restored to proposed dimensions and the project completed. Expenditures were for office expenses and contingencies.

The maximum draft that could be carried June 30, 1909, over the shoalest part of the channel was 6 to 7 feet at mean low water. The mean range of tides is 5 feet.

The commerce of this creek, mainly in clay, brick, tile, coal, tin scrap, steel scrap, and building materials, amounted in 1887 to 126,000 tons, in 1898 to 176,000 tons, in 1903 to 155,751 tons, in 1904 to 165,313 tons; in 1905 to 160,194 tons, valued at $1,018,198; in 1906 to 167,392 tons, valued at $1,128,237; in 1907 to 151,671 tons, valued at $1,071,548; and in 1908 to 163,120 tons, valued at $791,700. Tonnage heretofore reported in gross tons; reported this year in short tons.

It appears from inquiry that freight rates have been reduced as a result of this improvement.

It is proposed to apply the sum estimated as a profitable expenditure to maintenance of improvement.

Maps of the creek are printed in House Document No. 282, Fifty-sixth Congress, first session, and in Annual Report of the Chief of Engineers for 1905, page 1036.

July 1, 1908, balance unexpended	$928.16
Amount allotted from appropriation made by river and harbor act approved March 3, 1909	6,000.00
	6,928.16
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	507.80
July 1, 1909, balance unexpended	6,420.36
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	6,000.00

DELAWARE RIVER, PENNSYLVANIA AND NEW JERSEY.

Trenton, the head of natural and actual navigation of the Delaware River, is about 30 miles above the upper end of the port of Philadelphia. In its original condition this stretch of river was obstructed by several shoals. Between Bordentown and Trenton, a distance of about 5 miles, a narrow and circuitous channel existed which carried only from 3 to 6 feet at mean low water. At Kinkora bar, about 9 miles below Trenton, there was a shoal carrying 7½ feet, and at Fivemile bar, opposite the upper part of Philadelphia, a shoal crossed the Pennsylvania channel, carrying only 3 to 4 feet at mean low water. There was, however, a depth of 13 feet past Fivemile bar in the New Jersey channel south of Petty Island.

Below Philadelphia the river in its original condition presented obstructions at Mifflin bar which reduced the depth at mean low water to 17 feet, at Schooner ledge and Cherry Island flats to 18 feet, at

Bulkhead shoal and Baker shoal to about 20 feet, and at Duck Creek flats to about 20 feet. The lower end of Duck Creek flats is 56 miles below Philadelphia.

In that part of the Delaware River between Trenton, N. J., and Bridesburg, Pa., efforts in the past have been directed toward relieving commerce from the obstructions which exist in the upper 9 miles of the river and toward deepening the channels across Perriwig and Kinkora bars.

Previous to 1885 the efforts to improve the river between Philadelphia and the bay were confined to dredging, except at Schooner ledge, where solid rock was removed. The work was done under appropriations for special localities, and also under general appropriations for the Delaware River below Bridesburg.

A Board of Engineers, convened by direction of the Secretary of War for the purpose of considering the subject of the permanent improvement of Delaware River and Bay, recommended, in a project dated January 23, 1885, and adopted in that year, the formation of a ship channel from a point opposite Philadelphia and about midway between the American Ship Building Company's yard and the Gas Trust wharf to deep water in Delaware Bay, having a least width of 600 feet and a depth of 26 feet at mean low water. The formation of such a channel was to be secured, except at Schooner ledge, where rock would have to be removed, by regulating the tidal flow by means of dikes, with recourse to dredging where necessary, as an aid to such contracting and regulating works. The estimated cost of obtaining a channel of the above dimensions was about $2,425,000, which covered the estimated cost of the permanent improvement of the Delaware River between the upper part of Philadelphia and deep water in the bay. The annual cost of maintenance was estimated at 10 per cent of the original cost for dredging and 1 per cent of the original cost for dikes. This estimate of cost did not include the improvement of Philadelphia Harbor, which was a separate project.

With appropriations aggregating $3,935,000 there was completed between 1888 and 1898 a project for improving the harbor between Philadelphia, Pa., and Camden, N. J., which provided a channel depth of 26 feet at mean low water from Christian street, Philadelphia (Kaighn Point, N. J.), up to the Pennsylvania Railroad bridge at Fishers Point, N. J. In 1906 an allotment of $10,000 was made for redredging shoal places within the limits of this improvement, from the emergency appropriation contained in the river and harbor act approved March 3, 1905. Final report on the completion of this project is printed in the Annual Report of the Chief of Engineers for 1899, page 1330, and an account of the work done under the emergency allotment in the report for 1907, page 1100.

In the river and harbor act approved March 3, 1899, Congress adopted a new project for the improvement of the river, providing for the formation of a channel 600 feet wide and 30 feet deep from Christian street, Philadelphia, to deep water in Delaware Bay, at an estimated cost of $5,810,000. This project superseded the project of 1885. At the time of adoption of the new project the 26-foot channel, with widths varying from 200 to 600 feet, had been formed from the upper part of Philadelphia Harbor to the bay, except at the following-named localities: Tinicum Island shoal, depth from 23.6 feet

to 26 feet over a distance of about 4,200 feet; above Schooner ledge, depth from 24 feet to 26 feet over a distance of about 4,800 feet; from below Marcus Hook to Bellevue, depth from 23 to 26 feet over a distance of about 13,500 feet. These distances are measured on the range lines. The distances measured between the 26-foot curves on the lines of deepest water were much shorter.

Part of the 26-foot channel above Marcus Hook, Pa., was dredged by the city of Philadelphia under the supervision of this office, with money appropriated by the city of Philadelphia.

At the same time there was between Trenton and Philadelphia a channel 6 feet deep at mean low water through Perriwig bar, a depth of 7 feet in the eastern channel at Bordentown, a channel 8½ feet deep through Kinkora bar, and a channel 26 feet deep over the whole width through Fivemile bar.

The total amount expended on the 26-foot project since its adoption in 1885 was $1,532,688.81, of which about $200,000 is estimated to have been applied to maintenance. In addition to this expenditure the following sums were expended since the adoption of the 26-foot channel in 1885, and previous to adoption of the existing project, on special localities on the river under appropriations made for the purpose:

Channel across Smiths Island bar, between Philadelphia, Pa., and Camden, N. J.	$30,000.00
Between the upper part of Philadelphia, Pa., and Trenton, N. J.	37,500.00
Rebuilding and enlarging dike at junction of Schuylkill and Delaware rivers	3,000.00
Removing rock ledge opposite Petty Island	69,463.26
Expenses of Board of Engineer officers on project for channel 30 feet deep and 600 feet wide	7,000.00
Total	146,963.26

The entire amount expended on the improvement of Delaware River from 1836 to June 30, 1909, under appropriations for general river improvement, special localities, Philadelphia Harbor, and allotments from appropriations for emergencies in river and harbor works, was $13,420,754.23, of which $184,505.80 was expended on the part of the river between Trenton and Philadelphia, and $188,109.51 for maintenance under the existing project.

Work under the existing project below Christian street was commenced under an appropriation of $300,000 contained in the river and harbor act of March 3, 1899, and has been prosecuted under this and subsequent acts. Under the provisions of this act $69,463.26 was applied to removal of rock ledge opposite Petty Island, $7,000 to the expenses of the Board of Engineer officers on project for a 30-foot channel, and the balance, $223,536.74, under the existing project.

The river and harbor act approved March 2, 1907, appropriated the sum of $895,000 for completing this improvement and authorized the letting of contracts to the extent of $500,000 additional for maintenance of the dredged channel, this amount to be available, however, for use in completion of the project. Of this appropriation the sum of $40,000 is to be applied to maintenance of the dredged waterway in Philadelphia Harbor above Christian street, Philadelphia. Of the sum of $500,000 authorized by the river and harbor act of March 2, 1907, $375,000 was appropriated in the sundry civil act

approved May 27, 1908, and the balance, $125,000, was appropriated in the sundry civil act approved March 4, 1909.

The river and harbor act approved March 3, 1909, appropriated $390,000 for maintenance of the dredged channel from Philadelphia to Delaware Bay, including Philadelphia Harbor.

Up to the close of the fiscal year ending June 30, 1909, the sum of $6,383,671.61 was expended on the work of the existing project in surveys, in dredging at Duck Creek flats, Baker shoal, Salem Cove flats, Deep Water Point, Cherry Island flats, Schooner ledge rock area, Tinicum and Mifflin bar shoals, and in the construction of bulkheads for the reception of dredged material and to act as training walls to direct the currents.

At Baker shoal the work of bulkhead construction has resulted in the completion of 30,627 linear feet of structure. At Cherry Island flats the work of bulkhead construction has resulted in the completion of 4,535 linear feet of structure. The work of dredging under the 30-foot project has resulted in the formation of a channel 30 feet deep at mean low water and 600 feet wide, having the following approximate lengths through the various shoals:

	Feet.
Duck Creek flats	43,000
Baker shoal	20,500
Salem Cove flats	12,500
New Castle flats	28,000
Cherry Island flats	25,500
Edgemoor, Del., to the south line of Pennsylvania, including Marcus Hook bar	30,000

The work of rock removal at Schooner ledge is now about 99 per cent completed.

The greatest draft of water that could be carried at mean low water on June 30, 1909, over the shoalest part of the river below Philadelphia was about 23.9 feet on center line of channel on Cherry Island light-house range, near the mouth of Christiana River, Delaware. The material in the channel at this locality is very soft mud.

It is proposed to apply the available funds to completion of the project and maintenance of the dredged channel. This will include widening of the channel beyond 600 feet at the bends below Philadelphia, completion of rock removal at Schooner ledge, and surveys, engineering and office expenses under the general project, the work to be done by contract or by hired labor and government plant, as may be to the best interests of the United States.

In 1905 the State of Pennsylvania and the city of Philadelphia appropriated sums aggregating $750,000, to be expended in accordance with the general project on that part of the river between the south line of Pennsylvania and the city of Philadelphia. This money was to be expended by the city of Philadelphia, and the work to be done was to be under the supervision of the United States engineer officer in charge of the improvement.

Under date of July 27, 1906, the United States entered into an agreement with the city of Philadelphia whereby government plant should be placed on the work in sections 7 and 8 and operated under the direction of this office; all cost of the work to be paid by the city of Philadelphia. The city also entered into a contract with the American Dredging Company, under date of October 27, 1906, for the dredging of the entire channel to full width and depth in sections 6–A 6–B, and 9, for a lump sum in each case.

Work under the above agreement with government plant in sections 7 and 8 has resulted in a channel through Tinicum Island flats 30 feet deep and 600 feet in width, and a channel through Mifflin bar shoal 30 feet deep and 600 feet wide.

The contract dredging has resulted in a channel 30 feet deep and 600 feet wide through section 6, subsections A and B, on Schooner ledge range, and through section 9, to Christian street, Philadelphia.

The original work on the channel 30 feet deep and 600 feet wide is now practically completed from Christian street, Philadelphia, to deep water in Delaware Bay, except on Schooner ledge rock area, where a few scattering points of rock remain to be drilled and blasted off. It is estimated that only about 330 cubic yards of ledge rock remains to be removed, consisting of widely scattered points projecting from 0.1 foot to 1 foot above the plane of 30 feet mean low water. This work is being pushed as rapidly as is practicable, but from its nature is necessarily tedious.

For 1890 the total foreign freight movement of the Delaware River was estimated at 2,923,994 tons and the total domestic freight movement at 8,433,276 tons; total, 11,356,270 tons. For 1908 the total foreign freight movement was estimated at 5,083,487 tons and the total domestic freight movement at 18,940,408 tons; total, 24,023,895 tons.

The deepening of the channel below Philadelphia increases the number of deep-draft vessels trading with foreign ports. The establishment of existing lines has resulted in lower import and export rates. The maintenance of a deep channel from Philadelphia to the sea also affects the rates at other ports by keeping up the competition between them and this port. No exact figures can be given which will show the amount that freight rates have been lowered by the improvement.

It is proposed to apply the amount estimated for expenditure during the fiscal year 1911 to maintenance of improvement by dredging and repair of regulating works.

COMMERCIAL STATISTICS.

The following statement concerning the foreign commerce of the Delaware River for the years ending December 31, 1907 and 1908, is compiled from the reports of the Board of Trade of the city of Philadelphia:

Articles.	1907.	1908.
IMPORTS.	*Tons.*	*Tons.*
Drugs and chemicals	144,717	132,723
Hemp, jute, flax, and their fabrics	36,257	26,095
Iron, manufactured	31,396	13,545
Iron ore	600,598	585,126
Sugar	200,370	199,978
Miscellaneous	787,182	593,548
Total	1,800,520	1,551,015
EXPORTS.		
Coal	930,599	799,862
Grain and flour	581,013	653,716
Petroleum and products	1,124,673	1,188,277
Miscellaneous	1,420,431	860,617
Total	4,056,716	3,532,472

The following statement concerning the domestic and coastwise commerce of the Delaware River for the years ending December 31, 1907 and 1908, has been compiled from returns made by shippers, consignees, and carriers:

Articles.	1907.		1908.	
	Tons.	Value.	Tons.	Value.
ARRIVALS.				
Chemicals	312,560	$4,825,498	221,795	$3,938,315
Coal	715,493	2,553,793	684,684	2,593,165
Lumber	961,347	10,588,854	729,562	7,844,366
Sand	2,345,398	1,283,131	1,910,510	1,045,988
Miscellaneous	4,827,537	781,240,860	4,496,646	577,842,375
Total	9,162,335	800,492,136	8,043,197	593,264,209
DEPARTURES.				
Chemicals	119,385	2,344,170	95,508	2,175,450
Coal	7,877,432	30,764,762	7,150,315	27,854,154
Fertilizers	114,736	2,303,720	129,013	2,818,753
Iron, manufactured	20,096	485,198	13,320	400,000
Miscellaneous	4,132,309	573,344,187	3,509,055	469,721,940
Total	12,263,958	609,242,037	10,897,211	502,970,297

July 1, 1908, balance unexpended		$803,279.89
June 30, 1909, credited to appropriation during fiscal year: Sales of blueprints, $22.47; account services U. S. dredge *Delaware* in New York Harbor, $11,163.07; account of judgment in case of libel filed in U. S. district court for New Jersey against coal barge *Alaska* as damages sustained by the United States by reason of sinking by the barge of a scow belonging to the Engineer Department, $1,400; account proceeds of sales of condemned property, $604.43		13,189.97
Amount appropriated by river and harbor act approved March 3, 1909		390,000.00
Amount appropriated by sundry civil act approved March 4, 1909		125,000.00
		1,331,469.86
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$652,969.05	
For maintenance of improvement	179,399.34	
		832,368.39
July 1, 1909, balance unexpended		499,101.47
July 1, 1909, outstanding liabilities		104,294.64
July 1, 1909, balance available		394,806.83
July 1, 1909, amount covered by uncompleted contracts		141,475.80
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		200,000.00

The House committee in its report says:

The appropriation for the Delaware River includes an item of $450,000 for widening at the bends, which has been repeatedly recommended by the engineers in charge of the improvement as necessary to give a channel of equal efficiency throughout its length. At present the difficulties of navigation at the bends are great, and the widening provided for will be of material benefit to the commerce using the improvement.

The survey of the improvement with a view to securing a depth of 35 feet, provided for in the act of March 3, 1909, is nearing completion, but will hardly be in shape for consideration in this bill. The widening provided for will be an essential part of any larger improvement of the Delaware River that may be undertaken in accordance with any recommendation that may be submitted in the report on the survey now in progress, and therefore is a step toward securing improved facilities for the commerce of Philadelphia.

DELAWARE RIVER, AT MOUTH OF NEVERSINK RIVER, NEW YORK, NEW JERSEY, AND PENNSYLVANIA.

Report on a recent survey is printed in House Document No. 1164, Sixtieth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 5, 1908.

SIR: I have the honor to submit herewith for transmission to Congress reports of April 20, 1907, and March 20, 1908, with maps, by Maj. J. C. Sanford, Corps of Engineers, on preliminary examination and survey, respectively, of Neversink River, New York, with a view to the removal of bars and other obstructions at and near its mouth, and of Delaware River at and near the mouth of the Neversink River, this examination and survey having been made under authority of section 3 of the river and harbor act of March 2, 1907, as modified and extended by section 8 of an act of Congress approved May 28, 1908.

The improvement of this locality is requested in the interests of navigation and with a view to furnishing relief from the effects of floods due to ice gorges.

In his survey report of March 20, 1908, Major Sanford presents an estimate of $61,392.50 as the cost of the entire work which he deems necessary. Of this amount an item of $6,612.50 for the removal of a rock ledge known as "Sims Clip" is regarded as chiefly benefiting raft navigation; and he expresses the opinion that the General Government would be justified in making appropriation for this work, on condition that provision for the balance of the work, estimated to cost $54,780, be made by state and local interests. It is proposed that all the work contemplated shall be done under the supervision of the Secretary of War.

In its review of the survey report the Board of Engineers for Rivers and Harbors inclines to the belief that the cost of the work ($6,612.50) which it is proposed shall be borne by the United States is not disproportionate to the commercial benefits which may be expected from the improvement, and the Board concurs with the district officer in the opinion that if appropriation be made by Congress for this work its expenditure should be made contingent upon the furnishing by State or other interests of the sum of $54,780.

While the improvement contemplated in these reports may be of some benefit to the rafting interests, it is noted that the work is not demanded by those interests. Moreover, as the work which it is proposed shall be paid for by the United States is recommended only on condition that other work be done by other parties, it would appear that this portion of the improvement is not essential when taken by itself. In view of the fact, therefore, that none of the work can be recommended on account of commercial interests alone, and as these are the only interests on which the Chief of Engineers is called upon to express an opinion, I am constrained to omit a recommendation in this case, and merely present the facts for such action as Congress may deem proper to take, since any favorable action must primarily be for other interests than those of commerce.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

ERIE HARBOR, PENNSYLVANIA.

The following is printed in Rivers and Harbors Committee Document No. 26, Sixty-first Congress, second session:

WAR DEPARTMENT,
BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., February 4, 1910.

SIR: 1. The Board has had under consideration a resolution of the Committee on Rivers and Harbors of the House of Representatives, which reads as follows:

"*Resolved, by the Committee on Rivers and Harbors of the House of Representatives,* That the Board of Engineers for Rivers and Harbors created under section 3 of the river and harbor act approved June 13, 1902, be requested to reconsider the reports upon preliminary examination of harbor at Erie, Pa., printed in House Document No. 83, Sixtieth Congress, first session, with a view to submitting a recommendation

with estimate of cost of making the project depth of 20 feet available within the harbor at all times, the same as has been done in the entrance channel."

2. The document referred to in the resolution contains a report by the district officer on a preliminary examination of "Erie Harbor, with a view to obtaining a depth of 22 feet, * * * " ordered by the act of March 2, 1907. In its indorsement of June 17, 1907, reviewing that report, the Board made the following statement:

"It appears that the improvement now desired is an increase in depth at the entrance lakeward from the jetties, so that vessels of deep draft will not strike the bottom in time of high waves, and the widening and straightening of the dredged channel inside the jetties.

"It is claimed that large vessels have difficulty in navigating this inner channel, which is not in prolongation of the jetty channel, and therefore requires a change in direction, resulting frequently in vessels striking on the north side of the channel near the inner gas buoy No. 8. No special demands were made for an increase in depth in the inner harbor over that provided for by the existing project. The straightening of the channel inside the jetties appears to be a matter of detail which can be provided for in connection with the prosecution and maintenance of the existing project, and the Board is of the opinion that the maintenance of the full projected depth and width of channels through the jetties and at the entrance thereto will, in a great measure, overcome the difficulties complained of by navigation."

3. The views of the Board, as expressed above, having received the approval of higher authority, the necessary dredging has been done under the existing project to provide a depth of 20 feet at all stages in the outer channel and along the south side of the inner channel. From statements made to the Board in connection with the present investigation, it appears that a similar depth is needed in certain parts of the inner harbor to facilitate the handling of deep-draft vessels utilizing the full depth available in the entrance channel. The places where a depth of 20 feet at all stages is desired are indicated on the accompanying chart, and the cost of the work involved is estimated by the district officer as follows:

A. Inner channel along north channel line	$7,500
B. Project area of harbor basin, off Anchor Line-Pennsylvania elevators and docks	31,250
C. Project area of harbor basin, and extension northward, west of "B," city public dock frontage and dock frontage west thereof to waterworks	43,750
D. Shoal area off Erie and Pittsburg ore docks	30,000

4. Of the above, the Board believes that the dredging contemplated by "C" is not necessary nor advisable at this time, as this frontage is not used for commercial purposes employing deep-draft vessels. At "A," "B," and "D," however, such vessels are in use, and the board believes that it is advisable to undertake the dredging necessary to make the project depth of 20 feet available at these places at all stages. The estimated cost of this work, including 10 per cent for engineering and contingencies, is $75,625. An appropriation of this amount is recommended.

5. The Board further reports that there are no questions of terminal facilities, water power, or other subjects so related to the improvement proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures made in the interests of navigation.

For the Board:

Very respectfully,

W. C. LANGFITT,
Lieut. Col., Corps of Engineers,
Senior Member Present.

The CHIEF OF ENGINEERS, U. S. ARMY,
Washington, D. C.

ICE HARBOR AT MARCUSHOOK, PENNSYLVANIA.

In 1785 the Commonwealth of Pennsylvania built two wharves upon crib piers at Marcushook for the convenience of commerce. In 1829 an appropriation was made by Congress for repairing the piers and improving the harbor.

In 1866 a project was adopted for a harbor in Delaware River to protect vessels against moving ice. The old work at Marcushook was utilized as far as possible. The amount expended from 1866 to June 30, 1909, was $219,000. Since 1899 all expenditures have been

for repairs and maintenance. The last amount appropriated for the work was $5,000, by act of September 19, 1890.

The harbor covers an area of 12 acres, of which about one half has a depth of 12 to 18 feet and the other half 18 to 25 feet at mean low water. The protection consists of the old landing piers and seven detached piers, having foundations of wooden cribs filled with stone, the superstructures being faced with cut stone. The detached piers are in need of minor repairs.

During the past fiscal year repairs were made to the mooring posts and other parts of the piers.

It is proposed to apply the amount estimated for expenditure during the fiscal year 1911 to maintenance of improvement by the repair of superstructure of ice piers.

Rules for the use of the landing piers were approved by the Acting Secretary of War under date of April 29, 1904.

July 1, 1908, balance unexpended	$37.54
June 30, 1909, amount expended during fiscal year	37.54
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement	600.00

HARBOR AT PITTSBURG, PA.

This harbor comprises that portion of the Ohio River lying above Davis Island dam, a length of 4.7 miles; that portion of the Allegheny River lying between its mouth and Aspinwall, a length of 7 miles, and that portion of the Monongahela River lying between its mouth and McKeesport, a distance of 15.5 miles; total length of harbor, 27.2 miles. That portion of the harbor most used as such, and called the lower harbor, lies between the Davis Island dam and Dam No. 1 of the Allegheny and Monongahela rivers and measures 8 miles of river. In its original condition the lower harbor depths were from 3 to 4 feet on natural mean low river, and very often still lower stages caused suspension of navigation.

Since the completion of Davis Island dam, in 1885, the maximum draft which could be carried over the shoalest place was scant 8 feet at pool stage. Parts of the channel and harbor are from 10 to 12 and from 16 to 20 feet in depth. The average widths of the harbor at pool-full surfaces are: On the Ohio, about 1,100 feet; on the Allegheny, about 930 feet, and at different parts of the Monongahela, from 750 to 950 feet. The capacity of the harbor is impaired by shoal places and high dumps projecting from the banks. The use for harbor purposes of that portion of the harbor in the Allegheny River above the Sixth Street Bridge is practically nullified by the low bridges on that part of the stream. The clear heights of these bridges above their respective pool surfaces are from 27½ to 35½ feet. The least height, with chimneys down, of the packets that ply between Pittsburg and points on the Ohio, Kanawha, and Muskingum rivers is 45 feet. The average height of the Ohio River towboats, with chimneys down, is 44 feet. The height of a suitable packet for the Allegheny River is about 33 feet, and of a suitable towboat, about 28 feet. The result is that practically none of the coal and iron or steel products intended for southern shipments have been loaded or harbored in the Allegheny River. The removal of the Union Bridge at the mouth of the river has opened up this portion of the harbor as far as the Sixth Street Bridge, a distance of about one-half mile.

In 1858 the State of Pennsylvania, through a board of commissioners, made a detailed survey of the rivers at and near Pittsburg and laid down on the maps high and low water lines intended to define the banks and limit the use of the same by riparian proprietors. These lines were referred to stone monuments on the ground. No means, however, were provided for preserving the monuments nor for preventing filling in the river beyond these lines.

In 1894 a board of engineer officers recommended certain harbor lines for the harbor of Pittsburg, from the Davis Island dam to Brilliant, Allegheny River, and to Homestead, Monongahela River. The recommended lines generally followed the actual banks as they existed at that time. These lines were approved by the Secretary of War January 29, 1895. An extension of these lines on the Monongahela River from Homestead to McKeesport was approved by the Secretary of War April 3, 1902.

The original project for improvement was adopted by the river and harbor act of March 3, 1899, and provided, with subsequent modifications made during the progress of the work, for dredging a channel through the lower harbor (below dams No. 1 on the Allegheny and Monongahela rivers) where needed 10 feet deep at pool and 500 feet wide below Smithfield Street Bridge, Monongahela River, and of less width above this bridge and in the Allegheny River, limited by lines from ends of channel spans of the adjoining bridges, except at the Pan Handle railroad bridge, where the dredged channel, under modified project, was to have a width of 570 feet, including two channel spans; for raising the old riprap dam across Brunot Island back channel, Ohio River; for removing abandoned structures and unauthorized and obstructive fillings projecting from the banks beyond the harbor lines; for marking of harbor lines, and for inspecting and patrolling the harbor. Appropriations aggregating $110,662.90 were made and expended on this work.

The existing project provides for maintenance of the harbor at an annual estimated cost of $10,000. The amount expended under this project to June 30, 1909, was $39,894.74.

The greatest recorded flood height is 35.5 feet at Pittsburg. Ordinary flood heights average about 28 feet.

The principal commercial uses of the harbor are the mooring of coal fleets awaiting a rise in the Ohio for proceeding to destination on that river or on the lower Mississippi, the mooring of timber rafts and boat bottoms coming down the Allegheny River on rises, the delivery of coal and other materials to mills, furnaces, steel plants and yards, and the accommodation of the several packet lines plying on the three rivers and whose routes terminate at the harbor. Besides coal, considerable quantities of steel rails, cotton ties, sheet iron, wire, nails, etc., are shipped by barges to the lower river markets.

Commercial statistics.

Calendar year.	Products.	Passengers.	Calendar year.	Products.	Passengers.
	Tons.[a]			*Tons.*[a]	
1900	8,141,451	884,415	1905	12,269,020	603,716
1901	10,916,489	817,800	1906	12,927,975	271,450
1902	12,252,405	996,500	1907	14,395,816	533,280
1903	12,240,360	702,269	1908	9,090,146	267,043
1904	9,373,448	604,477			

[a] 2,000 pounds.

The improvement of this harbor is so closely connected with the slack-water system of the rivers emptying into it that it might well be said that, as far as effect on freight rates is concerned, this project is one and the same as the projects for the improvements of said rivers.

It is proposed to apply the $10,000 estimated as a profitable expenditure for the fiscal year 1911 to the maintenance of the harbor in accordance with the approved project.

July 1, 1908, balance unexpended	$1,901.69
Amount received from sale of blueprint maps	5.65
Amount allotted from appropriation by river and harbor act approved March 3, 1909	4,000.00
	5,907.34
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	2,749.39
July 1, 1909, balance unexpended	3,157.95
July 1, 1909, outstanding liabilities	44.99
July 1, 1909, balance available	3,112.96
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

ALLEGHENY RIVER, PENNSYLVANIA, OPEN-CHANNEL WORK.

The Allegheny River rises in northern Pennsylvania and flows northwestward into New York, and thence in a southerly direction into Pennsylvania to its junction with the Monongahela River at Pittsburg. The average fall per mile of the navigable portion is about 2.2 feet and the minimum discharge at Pittsburg is about 1,440 cubic feet per second. In its original condition the Allegheny River abounded in obstructions, such as bowlders, snags, islands, bars, and wide-spreading shoals, all of which rendered navigation at best hazardous and practicable only at such high stages of water as would enable craft to clear the obstructions.

The present project was adopted in 1878 and 1880 and contemplates the removal of the bowlders and snag obstructions and the construction of low dams and dikes to close secondary channels and concentrate the low-water flow on shoals.

The amount expended under this project to June 30, 1909, was $263,624.52, fully one-half of which was applied to maintenance.

The work that has been done enables navigators to operate safely on stages from 2 to 3 feet lower than formerly.

The present condition of the channel is generally satisfactory, having been largely cleared of the more objectionable obstructions, but to maintain its condition it is necessary to remove any bowlders or snags brought in by the tributaries or carried along by ice and freshets, and to make occasional repairs to the dikes and dams.

The greatest recorded flood height is 36.6 feet at Herr Island dam. Ordinary flood heights average about 30 feet.

Except on the lower 25 miles of the river the principal traffic is the downstream transportation of timber and lumber rafts, new coal-boat bottoms, barges and flats, usually loaded with tan bark, lumber, posts, railroad ties, and other timber products, and the

towage of gravel, stone, sand, etc. Steamboating is not now conducted to any material extent above Kittanning.

The annual commerce of the river above slack-water improvements in course of construction is about 200,000 tons, extending over 230 miles from Tarentum, Pa., to Olean, N. Y.

The effect of the work on freight rates is not very noticeable, as the depth of water has not been increased, but the hazard of boating has been greatly decreased.

It is proposed to apply the $5,000 estimated as a profitable expenditure for the fiscal year 1911 to maintenance of the existing channel and works of improvement.

July 1, 1908, balance unexpended		$2,290.80
Amount allotted from appropriation by river and harbor act approved March 3, 1909		1,000.00
		3,290.80
June 30, 1909, amount expended for maintenance of improvement during fiscal year	$915.32	
June 30, 1909, amount carried to surplus fund	1,375.48	
		2,290.80
July 1, 1909, balance unexpended		1,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, in addition to the balance unexpended July 1, 1909		5,000.00

ALLEGHENY RIVER, PENNSYLVANIA, CONSTRUCTION OF LOCKS AND DAMS.

Prior to the completion, in 1885, of the Davis Island dam in the Ohio River, 5 miles below its head, it was impossible to navigate the Allegheny River with steam craft of lightest draft during low-water periods, which frequently continued for months at a time. Since then a navigable depth of 8 feet has been afforded by that dam, when raised, to Garrison ripple, 2 miles up the stream.

The present project for lock and dam construction, originally adopted in 1890 and subsequently extended in 1896, provides for the construction of three locks and dams, extending slack water from the mouth at Tarentum, a distance of 25 miles. Dam No. 1 is movable, of Chanoine type, with bear-trap weirs. Dams Nos. 2 and 3 are both fixed, the former being built of concrete on pile foundation and the latter of crib construction. The lock chamber at No. 1 is 55 feet by 286 feet 2 inches; at Nos. 2 and 3, 56 feet by 289 feet 6 inches. The estimated cost of the work is $1,658,226.63, including $210,000 for restoration of dam, etc., at Dam No. 3. In addition $95,000 will be required to cover the restoration of bank at Dam No. 3, made necessary by the flood of 1907, and the payment of damages to private property resulting from the failure of the abutment.

The amount expended to June 30, 1909, was $1,658,804.47; of this amount $10,000 was expended for maintenance.

The condition of the work on June 30, 1909, was as follows:

Lock and Dam No. 1 (Herr Island), about 1½ miles from the mouth.—This work was built under contract and has been in operation since January 1, 1903.

The dam was first raised June 2, 1903. One double lock-masters' house has been built under contract.

Lock and Dam No. 2 (Aspinwall), 7 miles from the mouth.—The lock has been built under contract and has been in operation since November 10, 1906. The abutment and dam have been built under contract, with the exception of a portion of the abutment, which was built by hired labor.

Lock and Dam No. 3 (Springdale), about 17 miles from the mouth.—The lock was built under contract and has been in operation since September, 1904. The abutment and dam were built under contract. In January, 1907, during a moderate flood stage, the abutment failed and a portion of the dam had to be blown up to limit the resulting damage to private property. The abutment and dam have been rebuilt and the bank partly restored by hired labor.

Two lock houses have been built under contract.

Some dredging will be required in each of the three pools to secure the projected minimum depth of 7 feet.

The greatest recorded flood height is 36.6 feet at Herr Island dam. Ordinary flood heights average about 30 feet.

For the calendar year 1908 the commerce reported on that part of the river under the improvement for slack-water navigation was 536,129 tons of freight and 9,636 passengers.

The completion of these locks and dams will be of immense benefit to the manufacturing plants along the banks of the Allegheny River within their reach, by reason of connecting them with the harbor of Pittsburg and with the coal fields of the Monongahela River.

The effect of the project on freight rates is given in report on operating and care of locks and dams on Allegheny River.

In addition to the funds appropriated by the river and harbor act of March 2, 1907, for repair and reconstruction of Dam No. 3, an estimate of $95,000 is submitted by the district officer as the further amount required for restoration of the bank at the abutment of Dam No. 3 and for the payment of damages to private property resulting from the failure of the abutment in January, 1907. All of the claimants, except two with whom satisfactory agreements could not be made and whose claims, estimated at $365.25, have not been included, have signed agreements binding themselves to accept reasonable sums in full payment of their claims. These amounts aggregate $46,767.21, including 6 per cent interest for one year to cover delay in payment not contemplated in the agreements, and the remaining $48,232.79 is needed to restore land that was washed away. An appropriation of the amount ($95,000) required for this purpose is recommended for the favorable consideration of Congress.

MONONGAHELA RIVER, PENNSYLVANIA.

The improvement of this part of the river is considered to extend from Pittsburg to the mouth of Dunkards Creek, a distance of 87.5 miles. In its original condition, prior to 1840, it was navigable for steamboats only at high stages. A downstream navigation for light-draft flats and rafts was practicable at high and medium stages. The average fall per mile is about 0.9 foot and the minimum discharge about 160 cubic feet per second.

In 1833 Congress provided for a survey of the river from Pittsburg to Brownsville, a distance of about 57 miles. This survey was not followed by an appropriation for improving the river, and the legis-

lature of Pennsylvania, by act of March 31, 1836, incorporated and authorized the Monongahela Navigation Company to improve the river from Pittsburg, Pa., to the Virginia state line, a distance of 91.5 miles. This company built seven locks and dams, producing slack water from Pittsburg to within 2 miles of the West Virginia state line.

The river and harbor act of June 3, 1896, authorized and directed the Secretary of War to institute and carry to completion proceedings for condemnation of all the property and appurtenances of the company. The property was acquired by the United States on July 7, 1897, at a cost of $3,761,615.46.

The amount expended on original and modified projects prior to operations under existing project was $3,769,073.88, including the purchase money.

The existing project, adopted in 1899, with subsequent modifications (see Annual Report of the Chief of Engineers for 1906, p. 515), provides for the enlargement and improvement of Lock No. 6 and some additional structures at Lock No. 3, for the rebuilding of Locks Nos. 2, 3, and 5, using in each case two parallel chambers, each 56 by 360 feet, and fixed concrete dams with movable tops, and for the acquisition of necessary land and construction of certain improvements at Locks Nos. 5 and 6; all at a total estimated cost of $2,194,605.

The amount expended up to the end of fiscal year ending June 30, 1909, was $1,906,205.90.

Work is being carried on under continuing contract appropriations at new Lock No. 5, all the funds authorized for this work having been appropriated.

The condition of work on June 30, 1909, was as follows:

Lock and Dam No. 2.—The lock, power house, guard and guide walls, with the exception of upper 105 feet of upper guide wall, were built under contract. The abutment and dam were built by hired labor. The river lock has been in operation since August 15, 1905, and the land lock since March 5, 1906.

The existence of cross currents at this lock renders it necessary to extend the upper guide wall upstream and the middle wall downstream to provide safe and convenient access to the locks, and an estimate of $43,000 is included in this report to cover the cost of the work.

Lock and Dam No. 3.—The lock, guard and guide walls, the power house, power plant, and two lock-keepers' houses were built under contract. The abutment and dam were built by hired labor, the whole work being complete except for the raising of the upper sill of the river lock. The river lock was placed in operation May 20, 1907, and the land lock October 23, 1907.

Lock and Dam No. 5.—The contractors for the lock have completed the land and middle walls and the lower guide wall, and have nearly completed the river wall and upper guide and guard walls, only a small portion of their work remaining to be done. The abutment was built by hired labor, and work was well under way on the foundations for the first section of the dam, representing about 220 feet in a total length of 555 feet.

Locks Nos. 3 and 6, and floating plant.—All of the necessary structures at Lock No. 3, and the improvements contemplated at Lock

No. 6 have been nearly completed. All of the floating plant provided for in the existing project, consisting of a dredge and two dump scows and repair steamer with snagging appliances, has been completed and put in service. The necessary land has been acquired at Lock No. 6.

The greatest recorded flood height is 44 feet at Brownsville. Ordinary flood heights average about 30 feet on this portion of the river.

The traffic of the river is hampered and restricted by insufficient capacity and inconvenience at some of the old locks. This will not be overcome until the enlargement of Locks Nos. 1, 4, and 5 has been accomplished.

A statement of commerce and of the effect of the project on freight rates, so far as known, is given in the report for operating and care of locks and dams on Monongahela River, page 616.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, to the extension of upper guide wall upstream and of middle wall downstream at Lock 2 ($43,000).

It is very important that this old lock No. 4, built many years ago with dimensions that are now inadequate for the growing commerce of the river, should be rebuilt at the earliest practicable date, and it is therefore recommended that authorization be also given for the amount required to complete this work ($527,000), so that it may be carried on under continuing contract. This amount is larger than the estimate given in House Document No. 209, Fifty-eighth Congress, second session, the increase being necessary because of increased unit costs, etc.

A list of references to reports of examinations and surveys and other items of interest concerning this river are given on page 469 of Annual Report of the Chief of Engineers for 1905.

REBUILDING LOCK 2.

July 1, 1908, balance unexpended	$3,770.42
July 1, 1909, balance unexpended	3,770.42
Amount (estimated) required for completion of existing project	43,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	43,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

REBUILDING LOCK 3.

July 1, 1908, balance unexpended	$19,489.03
Amount received from sale of condemned property	313.77
	19,802.80
June 30, 1909, amount expended during fiscal year, for works of improvement	7,192.06
July 1, 1909, balance unexpended	12,610.74
July 1, 1909, outstanding liabilities	18.67
July 1, 1909, balance available	12,592.07

REBUILDING LOCK 5.

July 1, 1908, balance unexpended	$537,406.91
Amount appropriated by sundry civil act approved March 4, 1909	200,000.00
Amount received from sale of blueprint maps	4.45
	737,411.36
June 30, 1909, amount expended during fiscal year, for works of improvement	472,261.51
July 1, 1909, balance unexpended	265,149.85
July 1, 1909, outstanding liabilities	68,762.81
July 1, 1909, balance available	196,387.04
July 1, 1909, amount covered by uncompleted contracts	62,267.45

LOCKS 3, 6, ETC.

July 1, 1908, balance unexpended	$3,803.93
July 1, 1909, balance unexpended	3,803.93

LOCKS 5 AND 6.

July 1, 1908, balance unexpended	$3,700.00
June 30, 1909, amount expended during fiscal year, for works of improvement	13.75
July 1, 1909, balance unexpended	3,686.25

CONSOLIDATED.

July 1, 1908, balance unexpended	$568,170.29
Amount received from sale of condemned property	313.77
Amount appropriated by sundry civil act approved March 4, 1909	200,000.00
Amount received from sale of blueprint maps	4.45
	768,488.51
June 30, 1909, amount expended during fiscal year, for works of improvement	479,467.32
July 1, 1909, balance unexpended	289,021.19
July 1, 1909, outstanding liabilities	68,781.48
July 1, 1909, balance available	220,239.71
July 1, 1909, amount covered by uncompleted contracts	62,267.45
Amount (estimated) required for completion of existing project	[a] 43,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	[a] 43,000.00

YOUGHIOGHENY RIVER, PENNSYLVANIA.

The following is printed in Rivers and Harbors Committee Document No. 9, Sixty-first Congress, second session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., December 21, 1909.

SIR: 1. By resolution of the Committee on Rivers and Harbors of the House of Representatives, United States, and instructions from the Chief of Engineers, U. S. Army, the Board is required to "reexamine and reconsider the preliminary survey of the Youghiogheny River, from its mouth to Connellsville, in Pennsylvania, and report whether said river or any part thereof is worthy of improvement." The previous investigation referred to in the resolution was a preliminary examination of Youghiogheny River to Connellsville, made in compliance with the act of March 2, 1907.

[a] For Lock No. 2 only.

2. The report of the district officer on the preliminary examination contains a quotation from a report by his assistant, giving a description of the physical characteristics of the stream and the contiguous country, a statement of the resources of the locality, and a discussion of transportation conditions and the benefits which might be expected from a suitable improvement.

3. When reviewing the above-mentioned report, as required by law, the Board gave a hearing to certain interested persons at its offices in Washington, from which it appeared that the improvement was not desired so much on account of the mineral resources of the locality as on account of the commercial and industrial development which it would probably create by inducing the establishment of factories and other industries at sites along the banks of the river. The Board did not believe that these advantages would alone warrant the large expenditures involved, and in view of the improbability of an extensive use of the river for transportation, as indicated by the report of the district officer, the Board reached a conclusion unfavorable to the improvement.

4. Desiring to obtain an intimate knowledge of conditions, a committee of the Board made an inspection of the river on September 23, 1908, when the water was low, and on November 17, 1908, held a public hearing at Connellsville, at which representatives of the various interests concerned appeared and presented oral and written statements and arguments in behalf of the improvement of the stream. The interest in the improvement was much greater than at the time of the district officer's investigation. The communities affected are desirous of securing the benefits to be derived from a competitive water route, and it was represented that if such a route were provided a substantial traffic would utilize it.

5. In the report on preliminary examination it was explained that the stretch of 18.8 miles between West Newton and the mouth at McKeesport, having a total fall of 25.4 feet, could be improved for navigation by the construction of three locks and dams with a lift of 10 feet each, while the stretch of 25.6 miles from Connellsville to West Newton, having a fall of 122.6 feet, would require the construction of 12 locks and dams of this lift. These facts naturally suggest West Newton as the point of division of the river into two parts. At the instance of the Board the district office has submitted an estimate of cost of improving these two sections of river, as follows:

Between the mouth and West Newton: Three locks and dams, locks of single chamber 56 feet by 364 feet usable length, corresponding to the new locks of the lower Monongahela River, including accessory buildings, etc., at $350,000 each	$1,050,000
Between West Newton and Connellsville: Twelve locks and dams, locks 56 feet by 182 feet usable length, corresponding to the locks of the upper Monongahela River, at $260,000 each	3,120,000

6. It appears that there is considerable industrial development in the vicinity of McKeesport, at the mouth of the river. The pool formed by Dam No. 2 of the Monongahela River extends several miles up the Youghiogheny, and within this distance available sites have been occupied for manufacturing purposes. The statistics of commerce passing Locks Nos. 2 and 3 of the Monongahela during 1907 indicate that about 1,500,000 tons of coal, 265,000 tons of sand, and 600,000 tons of gravel were landed within this pool. It is claimed that over a thousand acres of manufacturing sites are available between McKeesport and West Newton, and it seems reasonable to believe that if competitive water transportation is provided over this portion of the river industries will gradually occupy these sites and the river be utilized for the carriage of their fuel and raw materials. It appears from a paper presented to the Board at the public hearing that at least 15 mines were in operation in 1907 between the mouth and West Newton, working the Pittsburg vein only, the aggregate output of which was about 2,500,000 tons. The representative of these companies who submitted this paper to the Board stated positively that all those companies desire this improvement, not only on account of any influence its completion might have on rates, but also that large amounts of coal and coke will actually be transported over the improved river. These statements were supported by others present. For these reasons, and on account of the awakened interest in the improvement and the positive assertion of mining interests that they will use the water route, the Board has reached the conclusion that the improvement of the river between the mouth and West Newton is now worthy to be undertaken by the United States, by the construction of three locks and dams at a total cost of $1,050,000.

7. On the stretch of river between West Newton and Connellsville there are few sites available for manufacturing purposes, and while the statements made as to the actual use of the river for transportation of coal apply to this portion of the river as well as the lower portion, the cost is so great that the Board is constrained to adhere

to the opinion formerly expressed that the Youghiogheny River between West Newton and Connellsville is not at present worthy of improvement by the United States.

For the Board:

Very respectfully,

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

HARBOR OF REFUGE, DELAWARE BAY, DELAWARE.

The project for the construction of this harbor, which was adopted and provided for under the continuous-contract system in the river and harbor act of June 3, 1896, includes the construction of a breakwater on the line of least depth along the eastern branch of the shoal known as the "Shears," and the construction of a row of ice piers across the upper end of the harbor to protect it from ice descending the bay, at a total cost not to exceed $4,665,000.

No expenditures were made on this improvement previous to June 30, 1896.

Up to the close of the fiscal year ending June 30, 1909, $2,238,205.34 had been expended in the construction of the breakwater and ice piers.

No part of this amount was applied to the maintenance of the work.

During the fiscal year ending June 30, 1904, the sum of $338.43 was expended on a survey of the harbor.

The breakwater was completed on December 11, 1901. The superstructure of the breakwater has a length of 7,950 feet and the substructure a length of 8,040 feet, measured on the low-water line.

A project for the construction of 10 ice piers was submitted on April 5 and approved April 23, 1900. This work was commenced during the fiscal year ending June 30, 1901, and completed November 22, 1902. Seventy-one thousand three hundred tons of stone was deposited in the work.

A project for the construction of additional ice piers was submitted under date of June 7 and approved June 30, 1902. Work under this project was begun August 4, 1902, and completed June 19, 1903. Thirty-seven thousand six hundred and seventy-three tons of stone was deposited, completing 5 ice piers.

A report was submitted under date of November 19, 1902, containing project and estimates for further protection of the harbor. A further report on this subject, containing a detailed project and estimate of cost of the proposed extension of the breakwater at this harbor, was submitted under date of November 14, 1903. Both reports and the recommendations of the Board of Engineers for Rivers and Harbors are published in House Document No. 548, Fifty-eighth Congress, second session, and also contained in the Annual Report of the Chief of Engineers for 1904, pages 1215–1225.

The great value of this harbor to commerce is due to its location. It is about equidistant from New York, Philadelphia, and the capes of Chesapeake Bay (the ocean entrance for the ports of Baltimore, Norfolk, and Newport News), and is therefore an especially convenient port of call for the entire commerce of the North Atlantic coast. It is now largely used by vessels awaiting orders to ports for discharge or loading. During the year ending December 31, 1908, 1,035 vessels (not including small craft) called at this harbor.

By the construction of the breakwater the usefulness of this anchorage has been greatly increased, not only as a port of call but also as a

harbor of refuge. Vessels bound from northern to southern or from southern to northern ports are able to go to sea in doubtful weather with the assurance of finding ample protection at the Delaware capes if overtaken by storm.

The unexpended balance of $1,128.66 was carried to the surplus fund on June 30, 1909.

It is proposed to apply the amount estimated for expenditure during the fiscal year 1911 to maintenance of improvement by the repair of detached piers.

July 1, 1908, balance unexpended	$1,128.66
June 30, 1909, amount carried to surplus fund	1,128.66
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement	8,000.00

IRON PIER IN DELAWARE BAY, NEAR LEWES, DEL.

The original project for this work proposed the construction of a landing pier about 1,700 feet in length, extending from the shore south of the breakwater into Delaware Bay, to a depth of 22 feet at mean low water, the pier to consist of a substructure of wrought-iron screw piles, surmounted by a timber superstructure. The work was commenced in 1871, and completed, except as to superstructure, in 1880.

The work done to June 30, 1890, resulted in the construction of 1,155 linear feet of pier 21 feet in width and 546 linear feet 42 feet in width, or a total length of 1,701 feet. The depth of water at the outer end of the pierhead was about 21 feet at mean low water. Since its construction the pier has been repaired and cared for by the United States.

The total expenditures to June 30, 1909, were $385,339.40. Of this amount, $27,000 was applied to the maintenance of the improvement.

The right to use the pier for railway purposes, granted in the act of July 15, 1870, has never been, and doubtless never will be, exercised, as the pier has not sufficient strength to support the weight of modern freight engines. It is therefore impossible to obtain any assistance from the railroad company in maintaining and repairing the structure.

During the past fiscal year no work was in progress.

The pier is of great use for the purpose of the government engineer, light-house, and quarantine services. It is of very great value to vessels frequenting the breakwater harbor in winter, when the harbor is packed with floating ice, rendering the anchorage dangerous. At such times vessels eagerly seek its shelter and protection. The unexpended balance of $820.60 was carried to the surplus fund on June 30, 1909.

The mean range of tide at the pier is 4.5 feet.

It is proposed to apply the amount estimated for expenditure during the fiscal year 1911 to maintenance of improvement by repair of pier.

July 1, 1908, balance unexpended	$820.60
June 30, 1909, amount carried to surplus fund	820.60
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement	1,500.00

WILMINGTON HARBOR, DELAWARE.

The harbor of Wilmington, Del., is in the Christiana River and includes a length of about 4 miles above its mouth at the Delaware River. It also includes the navigable portion of the Brandywine River (2 miles), which flows into the Christiana River at a point about 1¼ miles above its mouth.

Previous to 1836, when the first appropriation for the improvement of the Christiana River was made, the low-water depth at the entrance to this stream was about 8½ feet. The minimum depth in the channel in the portion of the river below Third Street Bridge, Wilmington, was 8 feet. This depth was increased in 1836 by dredging to 10 feet below low water, and under projects of 1871 and 1881 to 12 and 15 feet, respectively.

The present project is based upon a survey made in 1895 and adopted in river and harbor act of June 3, 1896. It provides for the formation, by dredging, rock removal, and construction of dikes, of a channel in the Christiana River 21 feet deep at mean low water from that depth in the Delaware River to the pulp works, a distance of about 4 miles, and thence diminishing to a depth of 10 feet at mean low water to the draw pier of the Philadelphia, Baltimore and Washington Railroad cut-off bridge No. 4, the width at bottom varying between 250 feet at the mouth and 200 feet at bridge No. 4. The project further provides for the removal of shoals from bridge No. 4 to Newport to a depth of 7 feet at mean low water. This project was completed in 1906. The depth made over the rock ledges just above and below the Third Street Bridge is about 21½ feet.

Further work contemplated is for maintenance of the improvement.

Under an act of the legislature of the State of Delaware approved March 9, 1901, authorizing and requiring the city of Wilmington to contribute to the extent of 10 per cent of the amount expended by the United States Government for the improvement of Wilmington Harbor, the sum of $4,400.54 was expended by the city of Wilmington in October and November, 1906, in dredging the channel between the Third Street Bridge and the Market Street Bridge, resulting in a continuous channel 75 feet wide and 17 feet deep at mean low water between the points named, and connecting them with the channel dredged by the General Government. This work was done under the supervision of the local United States engineer officer.

The city of Wilmington also, under the state law above referred to, appropriated the further sum of $6,567.41 as its contribution for the fiscal year 1909 for the improvement of Wilmington Harbor, but this money has not been expended or turned over for expenditure to the local United States engineer officer, as required by the state act, although readiness to expend it was expressed by him. This appropriation lapsed on June 30; an equal amount has similarly been appropriated for the fiscal year 1910, but no indications of its transfer or other expenditure have become manifest, although the local United States engineer officer has brought to the attention of the city authorities the urgent necessity therefor.

In 1907 slight repairs were made to the jetties at the mouths of the Brandywine and Christiana rivers.

Under contract completed July 16, 1908, the channel was dredged to a depth of 19 feet and a width of 250 feet from the 18-foot depth in

Delaware River to a point about 1,200 feet above Lobdells Canal, and 200 feet wide and 19 feet deep at mean low water from a point opposite Harlan & Hollingsworth's dry dock to a point about 150 feet above Market Street Bridge; and under a contract completed in November, 1908, the channel was dredged to a depth of 19 feet and width of 100 feet from the Pennsylvania Railroad cut-off bridge No. 3 to the mouth of the Brandywine, and from Third Street Bridge to Market Street Bridge to a depth of 18 feet and width of 100 feet, the depths made including 1 foot for overdepth allowed under the contract.

On April 2, 1909, the Chief of Engineers allotted $40,000 from the appropriation made by the river and harbor act of March 3, 1909, for preservation and maintenance of river and harbor works, and contract has been made for dredging with the available funds. Work under this contract was begun on June 11, and to the end of the fiscal year a length of 3,325 feet in the lower part of the river had been dredged to a depth of 19 feet at mean low water and a width of 150 feet.

On June 30, 1909, the condition of the channel was as follows: From the Delaware River to the Christiana light a depth of 17 feet at mean low water for a width of 150 feet; thence to Lobdells Canal 11 feet at mean low water for a width of from 100 to 250 feet; thence to Fourth street wharf 18 feet for a width of 90 to 180 feet; thence to Third Street Bridge 10 feet for a width of 200 feet; thence to Market Street Bridge 15 feet for a width of 200 feet; thence to Harlan & Hollingsworth Corporation's dry dock 18 feet for a width of from 100 to 150 feet; thence to the pulp works 12 feet for a width of about 80 feet; and thence to Newport 6 feet for a width of about 80 feet.

Between July 10 and 17, 1908, eighteen stumps and logs and parts of two wrecks were removed from the channel of the upper Christiana River above Churchman's bridge, at a cost of $265.98, with an allotment approved by the Secretary of War June 12, 1908, from the appropriation for emergencies made by the river and harbor act of March 2, 1907.

The maximum draft that could be carried on June 30, 1909, at mean low water over the part of the river under improvement was 13.5 feet to the pulp works and 6 feet thence to Newport. The stream is navigable to about one-fourth mile above the village of Christiana, or 15½ miles from the mouth. The tidal range at the mouth is slightly over 6 feet and at Christiana village about 3.6 feet.

The amount expended on this improvement from 1836 to June 30, 1909, is $994,403.96. Of this amount $592,282.75 was expended on the present project, of which $148,631.12 was for maintenance.

This is exclusive of $500.69 expended from appropriation for emergencies in removal of obstructions from the channel above Churchman's bridge.

The tonnage of the leading articles shipped to and from the port of Wilmington in the calendar year 1908 is reported to have been 738,403 tons, valued at $61,026,414.

The shipbuilding industry on the river is quite extensive, the records of the Department of Commerce and Labor showing that, with the exception of Philadelphia and Newport News, Wilmington has the largest steel shipbuilding output on the Atlantic coast for the ten years ending June 30, 1905.

The harbor improvements do not directly affect freight rates on light-draft boats to any extent. Shipments thereon made by water range about 25 per cent lower in rate than by rail, but much more in deep-draft vessels, of which there are many, covering shipments to and from the manufacturers and shipbuilding plants.

It is proposed to expend the funds recommended below in maintenance of the improvement in restoration of an 18-foot channel on project widths in the lower harbor and restoration of project depths and widths in the upper harbor to Newport, and in repairs to the superstructure of the north jetty at the mouth of the Christiana River, all in extending the benefits to navigation.

GENERAL IMPROVEMENT.

July 1, 1908, balance unexpended	$34,142.53
Amount allotted from appropriation made by river and harbor act approved March 3, 1909	40,000.00
Received from sales	426.26
	74,568.79
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	25,077.68
July 1, 1909, balance unexpended	49,491.11
July 1, 1909, outstanding liabilities	4,500.00
July 1, 1909, balance available	44,991.11
July 1, 1909, amount covered by uncompleted contracts	30,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	280,000.00

EMERGENCIES IN RIVERS AND HARBORS.

July 1, 1908, balance unexpended	$1,015.19
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	265.88
June 30, 1909, amount returned to Treasury to credit of appropriation	749.31

APPOQUINIMINK, MURDERKILL, AND MISPILLION RIVERS, DELAWARE.

(*a*) *Appoquinimink River.*—At the time of the adoption of the present project there was a mean low-water depth of 2 feet at the entrance into Delaware Bay, and the shoalest depth inside the river was 4½ feet. The most serious obstructions to the navigation of the river were the many bends in the lower and middle sections.

The approved project is based upon a survey made in 1889, and adopted by Congress in river and harbor act of September 19, 1890. It provides for a channel 8 feet deep at mean low water, having a width of 80 feet from the bridge at Odessa to New bridge, near Townsend's wharf, a distance of 3¼ miles, and a width of 100 feet from this wharf to the mouth of the river, a distance of 5 miles. The estimated cost of the improvement is $39,963.

A history of the work done up to June 30, 1905, may be found in the Annual Report of the Chief of Engineers for 1905, pages 175–176.

With $5,500 allotted by the Secretary of War in 1905 from the appropriation made by the river and harbor act of March 3, 1905, for improving Appoquinimink, Murderkill, and Mispillion rivers, a cut-

off was made through the neck of land on the left bank of the river leading to Fennimore's (or New) bridge, about halfway between the mouth and Odessa. This cut-off shortened the channel distance by 2,272 feet, the distance between Odessa and the 7-foot contour in Delaware Bay being now about 6¼ miles.

Under the provisions of the river and harbor act of March 2, 1907, the Secretary of War, on March 20, 1907, approved an allotment of $6,400 for expenditure on this improvement. Of this amount $5,000 pertained to the act referred to and the remainder was funds pertaining to former allotment. With these funds the channel has been dredged to not less than 7 feet deep at mean low water and 50 feet wide between Odessa and the mouth. No work was done during the year. The expenditure was for supervision expenses.

The maximum draft that could be carried on June 30, 1909, at mean low water in the river was 6½ feet, and across the flats at the mouth 4 feet. The range of tide is 6 feet at the mouth and 3½ feet at Odessa.

The stream is navigable for small craft to Noxentown milldam, about 4 miles above Odessa, making the navigable portion of the stream 10¾ miles long now.

The amount expended on the improvement to June 30, 1909, is $41,182.65, of which $9,140.24 was for maintenance.

About three-fifths of the work on the project has been completed.

The commerce of the river for the calendar year 1908 is reported to have been 30,975 tons, valued at $1,942,325.

The freight rates, it has been reported, remain about the same, but the passenger business has increased in consequence of the improvement of the river.

Under date of June 29, 1909, the sum of $5,000 was allotted from the appropriation made by the river and harbor act of March 3, 1909, to be applied to the maintenance of the improvement, and to utilize the available funds. Bids for dredging operations will be opened soon.

It is proposed to expend the funds recommended below in completing, to project dimensions, the channel of the river and in maintenance work, for an extension of the benefits to navigation.

Amount (estimated) required for completion of existing project..... $7,400.00

(*b*) *Murderkill River.*—This river is a tidal stream and a tributary of Delaware Bay and flows through Kent County, Del. Its navigable portion is about 9 miles long. The condition of the river was fair for the greater part of its length, the average width and depth being 90 and 6 feet, respectively. Outside the junction with Delaware Bay, however, there was a serious obstruction—the flats, which are nearly bare at low tide and extend for nearly a mile from the shore. The average rise and fall of the tide at the mouth is 4.6 feet, and 2½ feet at Frederica.

In 1881 an examination of this river was made and a project submitted for its improvement. No appropriation was made by Congress, however, as the river was at that time in the hands of an improvement and navigation company chartered by the State. This company had expended about $10,000 in rectifying the many bends of the river by cutting straight canals and in dredging a narrow cut across the flats at the mouth. The latter slowly filled up again.

Under the provisions of the river and harbor act of September 19, 1900, a survey was made, and report thereon is printed in House Executive Document No. 21, Fifty-second Congress, first session.

The project for improvement, which was adopted in the river and harbor act of July 13, 1892, is for a 7-foot low-water channel, 80 feet wide from the town of Frederica, at the head of navigation, to the mouth of the river, 8 miles, and 150 feet wide from the mouth, across the flats outside to the 7-foot curve of depth in Delaware Bay, the cut at the mouth to be protected by forming an embankment of the dredged material on each side, the estimated cost being $47,550.

Dredging for original work and for maintenance has been done at different times since 1893. A history of operations to June 30, 1905, will be found in the Annual Report of the Chief of Engineers for 1905, pages 177–178.

With funds derived from the river and harbor appropriations of March 3, 1905, and March 2, 1907, and emergency appropriations of 1905 and 1907, the river has been dredged at various points and across the flats at the mouth, resulting in a channel not less than 50 feet wide and 6 feet deep at mean low water from Frederica to the 6-foot curve in Delaware Bay.

About 50 per cent of the project has been completed.

With an allotment of $3,000 from the emergency appropriation provided by the river and harbor act of March 2, 1907, the channel was redredged in 1908 across the flats at the mouth and in the river, resulting in a continuous channel at least 6 feet deep at mean low water and at least 50 feet wide from Frederica to the 6-foot curve in Delaware Bay.

The maximum draft that could be carried on June 30, 1909, at mean low water in the part of the river under improvement is 5 feet from Frederica to the mouth and 5 feet across the flats to Delaware Bay.

Under date of May 1, 1909, the sum of $7,000 was allotted from the appropriation for preservation and maintenance made by the river and harbor act of March 3, 1909, and on July 2, 1909, proposals are to be opened for dredging therewith at the mouth and in the river.

The amount expended on this improvement to June 30, 1909, is $50,279.01, of which $26,918.23 was for maintenance.

The commerce of the river, which is quite varied, is reported for the calendar year 1908 as 29,478 tons, valued at $1,158,800.

As to the effect of the improvement of this stream upon freight rates, it is reported that rates by water are 25 to 50 per cent lower than by rail, and that in winter, when the boats can not run, the railroad increases its rates.

It is proposed to expend the funds recommended below in dredging the channel to full project dimensions as far as possible and in maintenance work for the purpose of extension of benefits.

Amount (estimated) required for completion of existing project..... $23,264.00

(*c*) *Mispillion River.*—This river is a tidal stream which enters Delaware Bay about 17 miles northwest of Cape Henlopen. It is navigable for about 13 miles. The mouth of the river was greatly obstructed by a flat foreshore without a channel. Vessels could enter and depart only at high water, the tidal range being about 4 feet.

The river from Milford, the head of navigation, to the mouth was improved by the General Government between the years 1879 and 1889; $17,000 was expended in making a channel 40 feet wide and 6 feet deep at mean low water. Its further improvement was carried on to November, 1906, under a project adopted in the river and harbor act of July 13, 1892. This resulted in a channel 40 feet wide and 4½ feet deep at mean low water from Milford to the mouth and 50 feet wide and 5 feet deep thence to the 5-foot contour in Delaware Bay; and two jetties at the mouth, one, the north jetty, extending from the east bank of the river a length of 1,645 feet, and the other, the south, or Green Point, jetty, extending from Green Point, just below the mouth of Cedar Creek, a distance of 1,100 feet, 500 feet of the outer end being parallel to and 100 feet distant from the axis of the dredged channel, and 200 feet from the north jetty.

The present project was adopted in the river and harbor act of March 2, 1907, and is based upon the report printed in House Document No. 102, Fifty-sixth Congress, second session. This provides for dredging the channel 6 feet deep at mean low water and 60 feet wide, increasing to 75 feet at sharp turns, from Milford to the mouth and thence 4 feet deep and 150 feet wide across the flats, and the construction of a jetty along the south side of the channel, at an estimated cost of $87,065.

From the appropriation made by the act of March 2, 1907, for improving the Appoquinimink, Murderkill, and Mispillion rivers, Delaware, $40,000 was allotted for the Mispillion, with which an extension has been built to the south jetty, 2,200 feet long, parallel to and 100 feet distant from the axis of the channel, and extending in a southeasterly direction into a natural depth of 2 feet at mean low water on the flats of Delaware Bay. Under a contract for dredging which was completed in July, 1908, the operations resulted in a channel not less than 5 feet deep at mean low water and 50 feet wide from the 4-foot curve in Delaware Bay to the light-house, and not less than 6 feet deep and 40 feet wide thence to the electric-light works in the town of Milford. The depth made includes 1 foot overdepth made under the contract.

About 35 per cent of the project has been completed.

The maximum draft that could be carried on June 30, 1909, at mean low water was 5 feet in the river and 2½ feet across the flats at the mouth. The tide rises 4½ feet at the mouth and 3½ at Milford.

The amount expended to June 30, 1909, is $115,935.83. Of this, $37,545.76 is on the present project, of which $4,339.80 was for maintenance.

Under date of June 17, 1909, the sum of $7,000 was allotted from the appropriation for preservation and maintenance of river and harbor works in the act of March 3, 1909, and it is intended to dredge the channel at the mouth and in the river at an early day.

The commerce of the river for the calendar year 1908 is reported to have been 171,034 tons, valued at $5,107,350.

The effect of the improvement on freight rates is stated to be quite marked, a reduction of an average of 25 per cent being reported; in addition, better and increased transportation facilities are afforded.

It is proposed to expend the funds recommended below in building 1,700 feet of jetty, completing the south jetty to its project length of

5,000 feet, in dredging the channel within the river and across the flats at the mouth to full project dimensions, and in maintaining the channel for the purpose of extending the benefits and making them more available.

Amount (estimated) required for completion of existing project..... $51,404.80

CONSOLIDATED.

July 1, 1908, balance unexpended		$11,891.66
Amount allotted from appropriation made by river and harbor act approved March 3, 1909		19,000.00
Received from sales of property		150.00
		31,041.66
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	$7,289.69	
Deposited to credit appropriation for emergencies in river and harbor works	61.49	
		7,351.18
July 1, 1909, balance unexpended		23,690.48
July 1, 1909, outstanding liabilities		26.40
July 1, 1909, balance available		23,664.08
Amount (estimated) required for completion of existing project		82,068.80
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		85,725.00

BROAD CREEK RIVER, DELAWARE.

This is a tributary of the Nanticoke River, and in 1881 the controlling depth was 1½ feet, with a mean range of tide of 3 feet. In 1889 a channel 6 feet deep at mean low water and 50 feet wide had been dredged under project dated February 4, 1880, from Bethel to Laurel, the head of navigation, about 7½ miles from the mouth of the river, at a cost of $35,000. The existing project, adopted by the river and harbor act of July 13, 1892, is for a channel 70 feet wide and 8 feet deep at mean low water between Bethel and Laurel, at an estimated cost of $15,000. The projected channel was dredged except for a short distance at the upper end, where it was reduced to 60 feet in width to secure the stability of some wharves. Contract was entered into and dredging under it finished in June of 1908, removing shoals above and for a distance of about 1,000 feet below the railroad bridge at Laurel. The appropriation requested is intended to be applied to maintenance.

The amount expended to June 30, 1909, is $16,500, of which $1,500 was for maintenance. The money expended during the fiscal year was for payment of retained percentages on contract, and proportion of office expenses. The project is completed and the additional work required is for maintenance.

The sum of $2,000 was allotted from the appropriation for preservation and maintenance of river and harbor works, act March 3, 1909, for maintenance, and the contract for the work is about to be entered into.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the channel is reported to be 7 feet.

One steamer and 34 sailing vessels, power boats, and barges are reported as plying in the river, the commerce being valued at $444,512.

The tonnage of the river for the year ending May 1, 1909, is reported to be 28,480, consisting of fertilizer, lumber, canned goods, flour and feed, shooks and crates, agricultural products, and general merchandise.

The improvement is reported to have made a reduction of 25 per cent in freight rates.

July 1, 1908, balance unexpended	$1,400.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	2,000.00
	3,400.00
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,400.00
July 1, 1909, balance unexpended	2,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	2,000.00

BROADKILL RIVER, DELAWARE.

In its original condition the depth of water in the river was from 3 to 4 feet at the numerous shoals which impeded navigation. The depth at the mouth was from 1½ to 2 feet at low water.

Prior to the adoption of the existing project $35,000 was expended in providing a channel within the river 6 feet deep and 40 feet wide at low water from the mouth to Milton, the head of navigation.

The existing project was adopted in the river and harbor act of March 2, 1907, and is based upon report and estimate submitted in House Document No. 214, Fifty-ninth Congress, second session. It provides for the establishment of a permanent entrance at the mouth of the river by dredging a channel from the 6-foot curve in Delaware Bay to the same depth in the river and constructing a jetty on the north side of this channel. The estimated cost of the project is $33,330.

The range of the tide is 4.1 feet at the mouth, 3.6 feet at the drawbridge, and 3.4 feet at Milton.

The act of March 2, 1907, appropriated $33,330, the amount estimated for the establishment of a permanent entrance at the mouth of the river, including the construction of a jetty on the north side of the channel. The title papers conveying to the United States the land required for the cut to be made across Lewes Cape have been approved by the Department of Justice; the jetty across Lewes Cape and Lewes Sound from the 6½ to 7 foot depth in Delaware Bay to the high-water line in the marsh of Lewes Sound on its western side, a total length of 1,263 feet, was completed in November, 1908; and a channel 6 feet deep and 150 feet wide at bottom was dredged from the 6-foot depth in Delaware Bay to the same depth in Lewes Sound. This work was done under contract.

Under date of October 20, 1908, the Secretary of War allotted $4,500 from the emergency appropriation and on December 16, 1908, a further sum of $3,200, to be applied to the restoration of a portion of the jetty, which was becoming undermined, and $7,282.67 thereof was applied to the work, which was completed in April, 1909. In addition, a fender wale was placed under the wale pieces for a length

of 1,104 feet, for the protection of the jetty from passing boats, at a cost of $250.

The maximum draft that could be carried on June 30, 1909, at mean low water over the cut under improvement was 4 feet. The whole of the projected work has been completed.

The effect of the improvement on freight rates by water has not yet been reported.

The amount expended on the improvement to June 30, 1909, is $75,658.61, of which $40,658.61 is on the present project. Of the latter amount, $7,532.67 was expended for maintenance.

The commerce during the calendar year 1908 is reported to have been 35,122 tons, valued at $750,825.

Under date of June 28, 1909, the sum of $3,000 was allotted from appropriation made by river and harbor act of March 3, 1909, for preservation and maintenance of river and harbor works, to be applied to the maintenance of the improvement, and with the available funds work at the mouth of the river will be commenced soon.

It is proposed to expend the funds recommended below in dredging and repairing the jetty for the maintenance of the improvement at the mouth to extend the benefits and to make the improvement more completely available.

July 1, 1908, balance unexpended		$25,669.73
Allotted from emergency appropriation, river and harbor act March 2, 1907.		7,700.00
Amount allotted from appropriation made by river and harbor act approved March 3, 1909		3,000.00
Received from sales of river and harbor property		100.00
		36,469.73
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$25,465.67	
For maintenance of improvement	7,532.67	
Returned to credit of appropriation for emergencies in river and harbor works	167.33	
		33,165.67
July 1, 1909, balance unexpended		3,304.06
July 1, 1909, outstanding liabilities		42.00
July 1, 1909, balance available		3,262.06
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of balance unexpended July 1, 1909		10,000.00

ST. JONES RIVER, DELAWARE.

Report on a recent survey is printed in House Document No. 1116, Sixtieth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 5, 1908.

SIR: I have the honor to submit herewith for transmission to Congress reports of April 26, 1907, and April 8, 1908, with map, by Maj. C. A. F. Flagler, Corps of Engineers, on preliminary examination and survey, respectively, authorized by the river and harbor act approved March 2, 1907, of St. Jones River, Delaware, from its mouth to Dover.

St. Jones River has been under improvement by the United States at various times since 1885. No definitely approved project exists at present and recent appropriations have been expended with a view to maintaining a channel 6 feet deep from Lebanon to the same depth in Delaware Bay.

In his survey report of April 8, 1908, Major Flagler presents a plan for a comprehensive improvement of the river from the mouth to Dover, a distance of 6 miles by river above Lebanon. This plan provides for a depth of 7 feet at mean low water, with widths varying in different reaches, and includes 16 cut-offs and a jetty on the north side at the mouth, all at an estimated cost of $185,000 and $1,700 annually for maintenance after completion. A modified plan at an estimated cost of $59,600 and $5,800 annually for maintenance is also presented. Both estimates include the cost of land needed for all cut-offs contemplated in the larger plan.

In forwarding the report to this office the division engineer, Col. D. W. Lockwood, Corps of Engineers, states that he is not inclined to favor the improvement of the river between Lebanon and Dover and that, in his opinion, the improvement proposed from Delaware Bay to Lebanon, including the dike at the mouth, promises the best results.

In its final report of October 26, 1908, also herewith, the Board of Engineers for Rivers and Harbors arrives at the conclusion that the combined interests of the locality are sufficient to warrant the improvement of St. Jones River under the larger plan proposed by the district officer, provided the right of way for the cut-offs be deeded free of cost to the United States and that private or other interests shall secure the United States against any damages due to the diversion of the river from its present course. Deducting the item for land for cut-offs the estimate submitted by the local officer amounts to $181,425, and to this extent the Board recommends the improvement proposed, subject to the conditions named.

I concur in the views and recommendations of the Board of Engineers for Rivers and Harbors.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

The present commerce of the stream is quite extensive, as shown in the printed reports for many years. In the calendar year 1906 the reported tonnage of freight received and shipped by water between Lebanon and the mouth was 55,196 tons, valued at $6,165,940. A regular steamboat line is operated between Lebanon and Philadelphia, and 11 steamers, 2 tugs, and numerous sailing vessels trade in the river at irregular intervals. Of the above-quoted present water commerce it is estimated that $1,080,000 pertains to Dover and vicinity, being hauled 3 miles to Lebanon in wagons to be shipped.

The St. Jones River from the mouth to Lebanon flows through marsh lands, and above Lebanon to Dover through a narrow, crooked valley, widening occasionally into low, muddy flats. By natural action the river has become exceedingly crooked, and without improvement would become more so. The present distance by river from Dover to the mouth is 17 miles. The air-line distances from Dover to Lebanon and from Lebanon to the mouth are 3.1 miles and 6.1 miles, respectively, or a total of 9.2 miles. In the improvement of this river it is the strongly expressed desire of the navigation interests that cut-offs be made to shorten the distance and to eliminate numerous sharp bends where it is almost impossible to maneuver a vessel without striking the banks. Such cut-offs are of additional advantage in improving the regimen of the river and diminishing the cost of maintenance.

SMYRNA RIVER, DELAWARE.

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 815, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., January 6, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

In the within report the district officer submits, with favorable recommendation, a project for the further improvement of Smyrna River, involving the redredging of the

river from Smyrna Landing to the mouth 60 feet in width in straight reaches, with widening at sharp bends, and 100 feet in width across the flats at the mouth, with a depth throughout of 7 feet at mean low water to the same depth in Delaware Bay; also the making of three cut-offs in the river, and the permanent protection by brush, stone, and pile jetties of the channel across the flats outside the mouth of the river. The cost of this work is estimated at $89,000 and the cost of its maintenance at $2,000 per annum, which is $3,000 less than the sum required for the maintenance of the present project.

In the opinion of the Board the cost of this improvement is reasonable when compared with the commerce of the stream, which in 1906 amounted to 207,021 tons, valued at $5,122,450. Approval of the project presented by the district officer is therefore recommended, but the excavation of the proposed cut-offs should be made contingent upon the donation to the United States of the necessary land, as suggested by the division engineer.

For the Board:

R. L. HOXIE,
Colonel, Corps of Engineers,
Senior Member Present.

HARBOR OF SOUTHWEST BALTIMORE (SPRING GARDEN), MD.

No work was done by the United States before the existing project, but the city of Baltimore dredged a channel from the main ship channel to the foot of Eutaw street, which had a controlling depth of 15-feet at mean low water. The average rise of the tide is a little over 1 foot. In response to a resolution of the House of Representatives an estimate was furnished March 7, 1896 (printed in Annual Report for 1896, p. 1006), of the cost of deepening the channel to a depth of 27 feet. It was for a channel 100 feet wide on the bottom, with side slopes of 1 on 3, from the main ship channel near Fort McHenry to the foot of Eutaw street, with a turning basin 400 feet by 400 feet near the upper end, at an estimated cost of $314,000, which is the existing project. Five thousand dollars was appropriated June 3, 1896, but it was deemed inexpedient to start the work with that small sum. June 13, 1902, $88,000 was appropriated and authority granted to enter into contracts for the completion of the work. A continuing contract was made for the completion of the project, and it was completed April 4, 1905. The sum of $314,000 was expended under the project for improvement, in addition to which $6,512.52 was expended for maintenance. Thirty-four thousand dollars was allotted from the appropriation for preservation and maintenance of river and harbor works, contained in the act of March 3, 1909, for restoring the channel to project dimensions as far as possible. A contract dated June 8, 1909, was entered into and operations begun. The sum of $34,000 more is required to entirely remove shoaling. This channel was dredged in very soft material, where silt has been slowly accumulating for many years. The cost of maintenance for a number of years will probably continue to be large, but after the side slopes have flattened out sufficiently it is thought that the cost of maintenance will be much reduced.

The maximum draft that can be carried June 30, 1909, at mean low water over the shoalest part of the locality under improvement is 27 feet at the lower end and about 16 feet at the upper end.

The stream is navigable in fact to Baltimore, Md., which is 14 miles from the mouth of Patapsco and 174 miles from the mouth of Chesapeake Bay. The length of the channel dredged under the existing project is 4 miles. It is stated that the improvement has

somewhat lowered freights, but the amount of reduction has not been ascertained.

The commercial statistics of the port of Baltimore include this harbor.

Amounted allotted from appropriation by river and harbor act approved March 3, 1909	$34,000.00
June 30, 1909, amount expended during fiscal year for maintenance of improvement	12.52
July 1, 1909, balance unexpended	33,987.48
July 1, 1909, outstanding liabilities	14.00
July 1, 1909, balance available	33,993.48
July 1, 1909, amount covered by uncompleted contracts	29,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	34,000.00

CHANNEL TO CURTIS BAY, BALTIMORE HARBOR, MARYLAND.

With a mean range of tide of a little over 1 foot, there was a controlling depth of 20 feet at mean low water in 1893, when the first improvement was undertaken by the United States. The original project was dated July 15, 1892, and was for a channel 27 feet deep at mean low water and a bottom width of 150 feet, at an estimated cost of $85,000. Forty thousand dollars of the estimate was appropriated, and with this total expenditure the channel was first made 25 feet deep for the project width and then dredged to 27 feet deep for a width of 70 feet in the axis of the 150-foot channel. That project was never completed. It was superseded by a project in the river and harbor act approved June 13, 1902, for deepening the channel to 30 feet and widening it to 250 feet, and authority was granted to make continuing contracts to complete the work. The estimated cost was $196,000.

A continuing contract was approved, and under it dredging was commenced March 5, 1903, and the project completed November 30, 1903.

The amount expended on existing project to June 30, 1909, was $196,012.52, of which $3,329.16 was for maintenance in partially removing some shoaling. This was done under contract. The sum of $9,000 was allotted from the appropriation for preservation and maintenance of river and harbor works contained in the act of March 3, 1909, for restoring the channel to project dimensions.

A contract dated June 8, 1909, was entered into for this work and the work commenced. The $10,000 asked for will be applied to maintenance of the channel where shoaling occurs, the additional work being necessary to make the improvement available to full project dimensions.

Curtis Bay is the mouth of Curtis Creek, which is navigable in fact 5⅛ miles above the head of the channel contemplated by the existing project, but a maximum draft of 28½ feet at mean low water can be carried June 30, 1909, over the shoalest part of the locality under improvement, which is a distance of 2⅛ miles.

It is stated that the improvement has lowered rates upon freight, but the amount of reduction has not been ascertained.

References to reports on examinations and surveys are to be found on page 180 of the Annual Report of the Chief of Engineers for 1904.

This bay is in the collection district of Baltimore and the statistics are attached to the report for that harbor.

Amount allotted from appropriation by river and harbor act approved March 3, 1909	$9,000.00
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	12.52
July 1, 1909, balance unexpended	8,987.48
July 1, 1909, outstanding liabilities	29.34
July 1, 1909, balance available	8,958.14
July 1, 1909, amount covered by uncompleted contracts	7,920.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

CRISFIELD HARBOR, MARYLAND.

This harbor is situated at Somers Cove, Little Annemessex River, which at this point is an estuary of Tangier Sound, on the east side of Chesapeake Bay. It is the principal port of the collection district of eastern Maryland. Crisfield is the head of navigation of the harbor and is 1 mile from its mouth. The length of the navigable portion of the harbor is 1¼ miles. Originally the harbor had a controlling depth of 8½ feet at mean low water for a width of 400 feet, with a mean rise and fall of tide of 2.6 feet, but this was not deemed adequate for the commerce of the port. The original project adopted by the river and harbor act of March 3, 1875, was for a channel 266 feet wide and 12 feet deep at mean low water from above the railroad wharf to a point known as the second angle, opposite Somers Cove light, and from that point to deep water below a channel of the same depth 425 feet wide, and in addition a basin on both the north and south sides of the railroad wharf 12 feet deep, at an estimated cost of $37,317.50. The work was completed May, 1876.

The act of March 3, 1905, authorized a survey, which was made in December, 1905, the report thereon being printed in House Document No. 783, Fifty-ninth Congress, first session. The existing project adopted by the river and harbor act of March 2, 1907, is to restore the channel formerly dredged and to restore and widen the anchorage basin, at an estimated cost of $37,706.62, and an annual cost for maintenance of $800. The estimated cost of the project was increased April 17, 1909, to $47,762. The river and harbor act of March 2, 1907, made an appropriation of $37,707. A contract was entered into and work under it completed in June, 1909. The project is about three-fourths finished. To June 30, 1909, $35,254.52 has been expended on existing project.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the channel under improvement was 12 feet. Funds asked for will be applied to completing the project.

Eight steamers and 536 sailing vessels and barges are reported as plying in the harbor, the commerce being valued at $8,221,918. The tonnage of the harbor is reported to be as follows: 1906, 30,265;

1907, 30,738; 1908, 102,982, consisting of lumber, canned goods, poultry and live stock, fish and oysters, agricultural products, and general merchandise. The improvement has made no appreciable difference in freight rates.

July 1, 1908, balance unexpended	$37,660.57
June 30, 1909, amount expended during fiscal year, for works of improvement	35,208.09
July 1, 1909, balance unexpended	2,452.48
July 1, 1909, outstanding liabilities	154.00
July 1, 1909, balance available	2,298.48
Amount (estimated) required for completion of existing project	10,055.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	10,055.00

HARBORS AT ROCKHALL, QUEENSTOWN, CLAIBORNE, AND CAMBRIDGE, AND CHESTER, CHOPTANK, WARWICK, AND MANOKIN RIVERS, AND TYASKIN CREEK, MARYLAND.

(*a*) *Rockhall Harbor and inner harbor at Rockhall.*—In 1894 the controlling depth at Rockhall Harbor was 5 feet, with an average range of tide of 1.1 feet. With an appropriation of $16,000, made June 3, 1896 (the first for this work), a project was carried out in 1897–98 for dredging a cut 80 feet wide and 10 feet deep at mean low water from the 10-foot curve in Swan Creek Inlet to the 10-foot depth in Chesapeake Bay, and a channel 100 feet wide and 10 feet deep from that depth in Swan Creek Inlet to the old pier at Rockhall. A turning basin, embracing the old and new piers, was also dredged.

In accordance with the river and harbor act of March 3, 1899, an examination was made of Rockhall Harbor and the inner harbor at Rockhall, report on which is printed in the Annual Report of the Chief of Engineers for 1900, pages 1670–1672. The project then proposed is dredging a channel 12 feet deep and 150 feet wide from Chesapeake Bay to Swan Creek Inlet, across Swan Point bar, and 12 feet deep and 150 feet wide from Swan Creek Inlet to the wharf at Rockhall, at a cost estimated in 1899 to be $43,065 and $9,208 every two years for maintenance.

The river and harbor act of June 13, 1902, adopted this project, which is the existing one. The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay, and $14,383.97 was allotted for this work.

Work under this allotment was completed during the present fiscal year, and resulted in completing the channel from the 12-foot contour in Swan Creek Inlet to the wharf at Rockhall, the turning basin to project dimensions, and in giving an 8-foot channel 70 feet wide for a distance of 2,240 feet across Swan Point bar. The unit price of dredging has exceeded that assumed in the original estimate. The estimated cost of project was increased May 13,1907, to $60,386.81.

The amount expended on this improvement to June 30, 1909, is $55,713.72, of which $16,600 was on a previous project and $537.54 for maintenance, consisting in the removal of a shoal in the inner harbor.

About two-thirds of the project has been completed. It is proposed to apply the funds asked for to completing the project.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the channel across Swan Point bar is about 5 feet and in the inner harbor 12 feet, to which point the improvement is navigable in fact. The harbor is a bay making in from Chesapeake Bay and is navigable in fact to Rockhall pier, which is about one-fourth mile above the mouth of Rockhall Harbor.

Two steamers and 65 sailing vessels and barges are reported as plying in the harbor, the commerce being valued at $1,678,870. The tonnage for the fiscal year 1909 was 17,703, consisting of lumber, coal, canned goods, poultry and live stock, fish, oysters, and general merchandise.

It is stated that the improvement has had no appreciable effect on freight rates.

Amount (estimated) required for completion of existing project..... $21,711.03

(*b*) *Queenstown Harbor.*—Before 1871 the controlling depth in this harbor was 6 feet, with a range of tide of about 2 feet. Between that year and 1880 it was improved under a project dated January 2, 1871, and a channel 100 feet wide at bottom and 8 feet deep at mean low water was made. In 1897, with $5,000 appropriated for continuing the improvement, a channel was dredged to 8½ feet at mean low water and 100 feet wide from Chester River to the inner harbor, to which point the bay is navigable in fact, and in 1900 a shoal extending from a point 138 feet above the lower light down for a distance of 950 feet was dredged to a depth of 8 feet and a width of 80 feet.

The river and harbor act of June 13, 1902, provided that the improvement should be made in accordance with the report submitted and printed in the Annual Report of the Chief of Engineers for 1900, pages 1673–1676. The project therein submitted contemplates increasing the dimensions of the channel so as to make them 10 feet deep and 200 feet wide, at an estimated cost of $23,100.

The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay, and $4,975.70 was allotted for this work.

A contract for expenditure of funds was entered into and dredging completed in the winter of 1907, advancing the project to that extent. Funds asked for are intended to continue the project and for maintenance. Owing to the insufficient appropriations, the work has been prolonged and the cost of maintenance is added to the original estimate. The unit price of dredging has exceeded that in the original estimate. The estimated cost of project was therefore increased May 13, 1907, to $25,886.35.

The amount expended on this improvement to June 30, 1909, is $40,572.39, of which $20,269.14 was on the existing project, and $1,303.25 for maintenance. The money expended during the fiscal year was for payment of retained percentages on contract work and proportion of office expenses. About four-fifths of the project has been completed.

The entire channel has been dredged to a depth of 10 feet, but the maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the locality under improvement was 9 feet.

Six steamers and 175 sailing vessels and barges are reported to ply in the harbor. The tonnage of the harbor is reported to be as follows: 1900, 12,373; 1901, 11,328; 1902, 18,769; 1903 (only partial statistics could be obtained), 3,889; 1904, 19,144; 1905, 19,421; 1906, 19,808; 1907, 20,202; 1908, 22,220, valued at $1,169,716, consisting of lumber, coal, agricultural products, canned goods, poultry and live stock, fish, oysters, and general merchandise.

The harbor is a bay making from the Chester River and is navigable in fact to Queenstown, which is about one-half mile above mouth of harbor. The improvement has made no perceptible difference in freight rates.

Amount (estimated) required for completion of existing project..... $5,607.40

(*c*) *Claiborne Harbor.*—Claiborne is on the eastern shore of Chesapeake Bay, about 6 miles east from Bloody Point light-house. No improvement there had ever been made by the United States previous to the existing project. The controlling depth was 9 feet at mean low water, with a mean range of tide of about 2 feet.

The act of June 13, 1902, adopted the existing project, which provides for dredging a channel 12 feet deep at mean low water and 300 feet wide from the 12-foot contour in Eastern Bay to the railroad pier in the harbor, a distance of about 1,900 feet, and thence shoreward along the south side of the pier to a width of 195 feet for a length of 500 feet, at an estimated cost of $17,490, and a further sum of $2,500 for an extension of the existing jetty should it be found necessary.

The jetty extension is now deemed necessary to preserve the north side of the channel to project dimensions from the current from Eastern Bay around Tilghmans Point, which, passing over the sand flats, carries material into the dredged channel at the outer end of the present jetty. The scour has been considerable in the last few years and has eroded Tilghmans Point, which formerly acted as a deflector, to such an extent as to render jetty extension necessary for the maintenance of the channel.

A 12-foot depth at mean low water was dredged with variable widths in the fiscal year ending June 30, 1904. The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay, and $3,440.24 was allotted for this work. A contract for expenditure of funds was entered into and dredging finished in the spring of 1908, which resulted in restoring the channel to dimensions left in 1905. Funds asked for are for completion of project. About three-fifths of the project has been completed.

There was allotted during the fiscal year the sum of $12,000 from appropriation for emergencies in river and harbor works, act March 3, 1909, to be applied to restoring the project channel, which has seriously deteriorated, and contract is about to be entered into.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the channel is 8 feet. The amount expended to June 30, 1909, is $20,307.29, of which $4,996.80 was for maintenance.

The money expended during the fiscal year was for payment of retained percentages on contract work and proportion of office expenses.

Owing to insufficient appropriations the work has been prolonged and the cost of maintenance is added to the original estimate. The unit price of dredging has exceeded that in the original estimate. The estimated cost of project was therefore increased May 13, 1907, to $27,408.30.

Claiborne is at the head of navigation in Claiborne Harbor, and is the western terminus of the Baltimore, Chesapeake and Atlantic Railway. It is about one-half mile from the mouth of the harbor.

Three steamers and 71 sailing vessels and barges are reported to ply in the harbor.

The tonnage of the harbor is reported to be as follows: 1903, 89,549; 1904, 90,435; 1905, 93,603; 1906, 91,957; 1907, 93,794; 1908, 103,173, valued at $7,975,500, consisting of agricultural products, canned goods, poultry and live stock, lumber, coal, and general merchandise. The improvement has made no appreciable difference in freight rates. Reference to a survey is to be found on page 185 of the Annual Report of the Chief of Engineers for 1904.

Amount (estimated) required for completion of existing project..... $14,597.81

(*d*) *Cambridge Harbor.*—This harbor is on the eastern side of the Choptank River, about 20 miles above its mouth, and Cambridge is the head of navigation at the mouth of the harbor. In 1870, before operations were commenced, there was a controlling depth of 4 feet, with a mean range of tide of about 1.7 feet. The improvement of the harbor was commenced in 1871 with a project submitted in March of that year for an entrance way of 100 feet in width and to provide sufficient harbor accommodations of a depth of 10 feet at mean low water. The estimated cost was $36,000. The sum of $10,000 was appropriated March 3, 1871, and work begun. On this and succeeding projects $50,237 was expended to June 30, 1896, resulting in a channel 150 feet wide and 12 feet deep at mean low water from that depth in the Choptank River to the railroad wharf, a distance of nearly a mile. The inner harbor below the bridge had been dredged over its whole irregular area to a depth of 10 feet, and the part of the harbor above the bridge for a distance of 750 feet had been dredged to a depth of 8 feet and a width of 215 feet. A survey was made in 1896 (printed in Annual Report of the Chief of Engineers for 1897, p. 1297), and the improvements then recommended were for a 12-foot low-water channel 150 feet wide from the 12-foot curve in the Choptank River to a point 500 feet outside the Baltimore, Chesapeake and Atlantic Railway Company's steamboat wharf, and from this point gradually widening to the harbor line at the wharf; from the steamboat wharf to Mill wharf to increase the width an average of 200 feet, with a depth of 8 feet, making an anchorage basin; increasing the width of the lower harbor 40 feet on the north side and widening the upper harbor an average of 360 feet along the channel already dredged to a depth of 8 feet. The estimated cost of the project was $8,120. It is the existing one.

The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay, and $1,531.63 was allotted for this work. A contract for expenditure of funds was entered into and dredging under it finished in the summer of 1907, resulting in advancing part of the 8-foot project and removing some shoals in the 12-foot part of the project.

The amount expended on this improvement to June 30, 1909, is $57,846.78, of which $50,237 was on previous projects and $244.76 for maintenance.

Owing to insufficient appropriations the work has been prolonged and the cost of maintenance is added to the original estimate. The estimate of cost of project was increased May 13, 1907, to $13,858.25. The project is about five-eighths completed. All funds are intended to be applied to continuation and maintenance of the project. The money expended during the fiscal year was for payment of retained percentages on contract work and proportion of office expenses.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the channel below the bridge was 10 feet, and about 8 feet above as far as the channel has been dredged.

Six steamers and 152 sailing vessels and barges are reported to ply in the harbor, the commerce being valued at $2,227,659. The tonnage of the river is reported to be as follows: For the year ended May 1, 1909, 66,703, consisting of grain, lumber, coal, fertilizer, canned goods, fish and oysters, and agricultural products. The improvement has made no appreciable difference in freight rates.

Amount (estimated) required for completion of existing project..... $6,450.58

(*e*) *Chester River, Maryland, from Crumpton to Jones Landing.*—Before operations were undertaken on this part of the river, vessels at low tide drawing 6 feet of water could reach Crumpton, 33 miles above the mouth, and from that point to Jones Landing (to which point the stream is navigable in fact), 6¼ miles, the controlling depth was 3 feet, with a mean range of tide of 2.4 feet. The project for improvement adopted by the river and harbor act of September 19, 1890, is for a 6-foot low-water channel from Crumpton to Jones Landing, at an estimated cost of $12,750, increased in 1896 to $14,250, and still later to $19,562.50. There has been but one project for this section of the river.

Before the adoption of the present project there had been appropriated for this river $41,000, of which $2,958.54 was carried to the surplus fund on June 30, 1909.

The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on the east shore of Chesapeake Bay, and $2,417.36 was allotted for this work. A contract for expenditure of funds for maintenance was entered into and dredging for maintenance under it finished in the winter, restoring project dimensions from Crumpton to Ford's wharf.

The sum of $5,000 was allotted from the appropriation for preservation and maintenance of river and harbor works, act March 3, 1909, for maintenance, and a contract for the work is about to be entered into.

The amount expended on this improvement to June 30, 1909, is $23,264.36, of which $5,604.88 was for maintenance. The project is completed.

The money expended during the fiscal year was for payment of retained percentages on contract and proportion of office expenses.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the river was 4 feet.

Six steamers and 175 sailing vessels and barges are reported to ply in the river, the commerce being valued at $3,917,210. The tonnage

of the river is reported to be as follows: 1906, 48,199; 1907, 49,162; 1908, 54,078, consisting of lumber, poultry and live stock, fish and oysters, canned goods, agricultural products, and general merchandise. The improvement has made no appreciable difference in freight rates.

It is proposed to apply funds asked for to removing shoals that have formed in the channel since it was dredged.

(*f*) *Choptank River, Maryland.*—Before improvements were begun in 1879 the depth of water in the channel between Denton and Greensboro varied from 2 to 8 feet, with a mean range of tide of about 2 feet. Navigation, carried on by small sailing vessels, extended to only 3 miles above Denton. Upon the remaining 5 miles to Greensboro, the head of navigation, all freight had to be transported upon scows. Greensboro is about 46 miles above the mouth of the river.

A project for improvement was made in 1880 for an 8-foot low-water channel 75 feet wide, at an estimated cost of $79,000. At the close of the fiscal year 1903 the project channel had been completed, except for a distance of about 1 mile at the upper end, but there has been some shoaling since.

The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay, and $9,662.55 was allotted for this work. A contract for expenditure of funds was made and dredging under it completed in 1908 and resulted in completing the project except for a distance of about 1,200 feet. About one twenty-fifth of the project remains to be done.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the channel under improvement was 7 feet.

The amount expended on this improvement to June 30, 1909, was $80,502, of which $4,344.69 was for maintenance. The amount expended during the fiscal year was for payment of retained percentages on contract and proportion of office expenses.

Six steamers and 251 sailing vessels and barges are reported as plying in the river, the commerce being valued for the past calendar year at $17,743,390. The tonnage of the river is reported to be as follows: 1903, 208,367; 1904, 210,447; 1905, 212,725; 1906, 208,496; 1907, 212,661; 1908, 233,916, consisting of lumber, coal, canned goods, poultry and live stock, fish and oysters, agricultural products, and general merchandise. The improvement has made no appreciable difference in freight rates.

It is proposed to apply the funds asked for to completing the project and maintenance.

Amount (estimated) required for completion of existing project..... $2,797.14

(*g*) *Warwick River, Maryland.*—This river, formerly named Secretary Creek, is in Dorchester County, eastern shore of Maryland, and flows into the Choptank River, one of the largest tributaries of Chesapeake Bay. It is a small tidal basin 2 miles long, with no fresh-water influx at the head, and was originally only 4 feet deep. The average rise of tide is 2 feet. The original project for the stream is dated January 20, 1880.

Before the adoption of the present project about $12,000 had been expended in the improvement of this river—$6,000 by the General Government and the remainder by private parties. The existing proj-

ect for improvement, based upon a survey in 1891 (printed in Annual Report of the Chief of Engineers for 1891, p. 1219) and adopted by the river and harbor act of July 13, 1892, provides for a channel 100 feet wide and 10 feet deep at mean low water from the 10-foot depth in Choptank River to Secretary Landing, at the head of the river, including a turning basin at the latter point, at an estimated cost of $18,600. The project was completed in July, 1903, but shoals formed rapidly.

The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay, and $3,493.87 was allotted to this work. A contract was entered into and the dredging finished under it in the summer of 1907, restoring the project dimensions from the turning basin to Cedar Point. Funds asked for are intended to be applied to maintenance.

The sum of $3,000 was allotted from the appropriation for preservation and maintenance of river and harbor work, act March 3, 1909, for maintenance, and a contract for the work is about to be entered into.

The amount expended on present project to June 30, 1909, is $21,402.87, of which $5,362.05 was for maintenance. The money expended during the fiscal year was for payment of retained percentages on contract and proportion of office expenses. The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the channel under improvement was 9 feet.

Six steamers and 80 sailing vessels and barges are reported as plying in the river, the commerce being valued at $3,441,826. The tonnage of the river is reported to be as follows: 1903, 65,206; 1904, 65,858; 1905, 66,631; 1906, 60,027; 1907, 61,225; 1908, 67,346; consisting of lumber, canned goods, poultry and live stock, fish and oysters, agricultural products, and general merchandise.

The improvement has made no appreciable difference in freight rates.

(*h*) *Manokin River, Maryland.*—Before improvements were commenced in 1891 the depth of water at the mouth of the river at the so-called "Mud flats" was between 1 and 2 feet at low tide. These flats are about 2½ miles wide and make navigation impossible except at high water, thereby rendering the upper part of the river, which has a very fair depth and width, almost useless for extensive shipping purposes. The average rise of tide at the flats is 2.6 feet. Princess Anne is the head of navigation and is about 12 miles above the mouth of the river.

The project was adopted by the river and harbor act of September 19, 1890, and is based upon a survey made in August and September, 1889. (Report printed in Annual Report of the Chief of Engineers for 1890, p. 961.) It provides for a channel 6 feet deep at mean low water and 100 feet wide from Locust Point to Sharps Point, a distance of about 2½ miles and embracing the section called the "Mud flats," at an estimated cost of $30,000.

From 1891 to 1900 dredging on the whole project was done at various times as funds became available. At the close of these operations there was a channel 6 feet deep from Sharps Point to about a mile above Dashiells Creek and a slightly less depth to the steamboat wharf above, and at the mouth soundings taken over the area formerly dredged showed a range of depth from 4.5 to 7.3 feet. No work was

done afterwards until that of the autumn of 1905, which consisted in removing shoals that had formed, and resulted in a controlling depth of but 3 feet.

The creation and maintenance of a channel across the mud flats at the mouth of this river is a work of some difficulty and uncertainty under the method adopted, which was originally considered as tentative only and the best that the commercial importance of the project would justify. Funds have not been available for adequate maintenance and the channel has deteriorated rapidly. The estimate of cost of project was increased May 13, 1907, to $42,103.99. The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay, and $9,160.69 was allotted for this work. A contract for expenditure of funds was made and dredging under it completed in June, 1908.

The amount expended on the improvement to June 30, 1909, is $36,407.69, and $2,000 additional was expended on the upper river, which is not included in the existing project. The amount expended for maintenance was $8,511.13. About two-thirds of the project is completed. The money expended during the fiscal year was for payment of retained percentages on contract and proportion of office expenses.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the channel at the mouth was 3½ feet.

It was impracticable to procure commercial statistics. The improvement had made no appreciable difference in freight rates.

It is proposed to apply the funds asked for toward completing the project.

Amount (estimated) required for completion of existing project..... $14,181.93

(*i*) *Tyaskin Creek.*—This stream is also known as Wetipquin Creek, or River. It is a small tributary of Nanticoke River, having a length of about 5 miles. The controlling depth in the creek was 8 feet, but on the bar at the mouth it was but 3½ feet at mean low water, with an average rise and fall of the tide of 3 feet. A survey was made in 1899 (report printed in Annual Report of the Chief of Engineers for 1900, p. 1681). The existing project, which is the original one, was adopted by the river and harbor act of June 13, 1902, and is for a channel 9 feet deep at mean low water, with a width of 120 feet, at an estimated cost of $13,200. Under a survey made in January, 1906, the estimate of cost of completion of this project, with a suitable turning basin added, is $6,462.39.

The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on the east shore of Chesapeake Bay, and $6,500 was allotted to complete this work. A contract was made for completion and dredging was finished, as far as funds permitted, in the spring of 1908. The channel was completed to the project depth and width, but owing to shoaling since the survey and estimate were made in January, 1906, the turning basin was left at a controlling depth of 7 feet at mean low water, which is ample for present needs. Funds asked for are intended to be applied to completing turning basin and maintenance of project.

The amount expended to June 30, 1909, is $16,556.32, of which $2,443.91 was for maintenance and $3,954.41 on project as modified

by estimate of January, 1906. The project is about two-thirds completed. The money expended during the fiscal year was for payment of retained percentages on contract and proportion of office expenses.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the improvement was 8 feet and the turning basin 7 feet.

Three steamers and 36 sailing vessels and barges are reported as plying in the creek, the commerce being valued at $78,710. The tonnage of the creek is reported to be as follows: 1903, 784; 1904, 796; 1905, 856; 1906, 945; 1907, 967; 1908, 1,064, consisting of lumber, canned goods, poultry and live stock, agricultural products, and general merchandise.

The improvement has made no appreciable difference in freight rates.

Reference to reports on examination and survey required by the river and harbor act of March 3, 1905, will be found on page 214 of the Report of the Chief of Engineers for 1906.

Amount (estimated) required for completion of existing project	$2,406.30

CONSOLIDATED.

July 1, 1908, balance unexpended		$26,459.68
Amount allotted from appropriation by river and harbor act approved March 3, 1909		25,500.00
		51,959.68
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$23,120.29	
For maintenance of improvement	3,018.30	
		26,138.59
July 1, 1909, balance unexpended		25,821.09
Amount (estimated) required for completion of existing project		67,752.19
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		80,000.00

LOWER THOROUGHFARE, WENONA, DEAL ISLAND, MARYLAND.

Deal Island is about 3 miles long and half as wide, situated in Tangier Sound, Maryland, with the town of Wenona at the south end. About one-third of the area is under cultivation, but the 1,900 inhabitants of the island are chiefly engaged in fish, oyster, and crab traffic. There are 2 oyster and crab packing houses, 16 general stores, 2 schools, and 3 churches. The commerce, which is local in character (trading with Baltimore and Crisfield), is carried in 2 schooners, 31 sloops, 1 bugeye, and 300 other smaller sailing craft, aggregating 1,965 tons, with extreme loaded drafts from 2½ to 7½ feet. The receipts and shipments by water for the year ended April 1, 1907, were 10,251 tons, valued at $157,600, and consisted of general merchandise, cord wood, cordage, oysters, crabs, fish, and agricultural products. If adequate facilities are provided, one or more of the steamers navigating Chesapeake Bay will probably make a landing at Lower Thoroughfare, which will provide rapid transit for perishable fruits grown on the island and for the natural increase due to improved navigation and safe anchorage.

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 76, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., June 5, 1907.

Respectfully returned to the Chief of Engineers, United States Army.

The district officer proposes to restore to a depth of 6 feet the channel and turning basin heretofore dredged in Lower Thoroughfare between Deal Island and Little Deal Island, widening the channel 100 feet at the angles and extending the turning basin 100 feet, to provide easy navigation for steamers and a suitable protected anchorage. This work is estimated to cost $5,284.62 and its maintenance $200 per annum.

The commerce of the locality and the benefits to be expected from the improvement were considered in the district officer's report on the preliminary examination and in the Board's report of review. Comparing these benefits with the cost of the work now proposed and that formerly prosecuted, having in mind the small expenditure required for maintenance, the Board concurs with the district officer in the opinion that an improvement to the extent indicated above is justified by the commercial interests involved and that it is advisable for the United States to undertake the improvem ent

ELK RIVER, MARYLAND.

Before improvements were commenced there was practically no navigation above Cedar Point. The original project, dated June 23, 1874, was for a channel 6 feet deep at low water, or 8 feet at high water, from Cedar Point to Elkton, the head of navigation, and in the Little Elk as far as Bennett's wharf. The mean range of the tide is 2 feet. Such a channel was estimated to cost $36,000 if 75 feet wide and about $25,000 if 50 feet wide, cheap dikes being required for regulating the banks and to provide a place behind which to deposit the material dredged from the shoals. The first work was done in 1874, when $5,000 was expended in building a dike and dredging to a width of 25 feet and a depth of 6 feet at mean low water in front of it and for about 300 feet below. Two years later the channel was made 40 feet wide from the bridge at Elkton to about one-half mile below. In 1884 a channel was completed 80 feet wide through the bar near the mouth of the Little Elk River and 70 feet wide thence to the bridge at Elkton, the depth being 7 feet at mean low water. In 1893 a channel 100 feet wide and 8 feet deep from deep water below Cedar Point to the bridge at Elkton was completed. The expenditure on the original and subsequent projects has amounted to $46,500.

The channel had shoaled, and in a report on a survey made in 1899 (printed on pp. 1668–1669, Pt. 2, Annual Report of the Chief of Engineers for 1900) it was proposed to restore the channel to 8 feet depth at mean low water and 100 feet wide from deep water below Cedar Point to the bridge at Elkton, at an estimated cost of $16,665, with an annual cost of $2,500 for maintenance. The river and harbor act of June 13, 1902, adopted this project, and appropriated $16,665 for the work. This appropriation was practically expended in dredging in the fiscal year ending June 30, 1903. The project width of 100 feet could not be made, as the river was found to have shoaled very much since the survey in 1899, on which the appropriation was based.

The existing project adopted by the river and harbor act of March 2, 1907, is for a channel 6 feet deep at mean low water and 100 feet wide from Elkton to Cedar Point, at an estimated cost of $16 802.77. The act appropriated $18,803 for its completion and maintenance. A

contract was entered into and the project completed in March, 1908. Nevertheless extensive shoaling has already taken place, and it is doubtful whether the project can be maintained without annual dredging to an extent much greater than was anticipated. The sum of $10,000 is now required.

The sum of $10,000 was allotted from the appropriation for preservation and maintenance of river and harbor works, act March 3, 1909, for maintenance, and a contract for the work is about to be entered into.

The amount expended on this improvement to June 30, 1909, is $83,968, of which $63,165 was on previous projects, $16,439.24 on present project, and $4,363.76 for maintenance. The amount expended during the fiscal year was for payment of retained percentages on contract work and part of office expenses.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the river was 3½ feet. The stream is navigable, in fact, to Elkton, Md., which is about 16 miles from the mouth of the river. It was stated that the improvement has materially reduced freight rates.

The commerce of the river for the calendar year 1908 is reported to be 42,880 tons, consisting of vessels built, cord wood, lumber, fertilizer, hay, and flour, valued at $258,847. Two steam tugs and 171 schooners and barges are reported as plying in the river.

July 1, 1908, balance unexpended	$1,770.67
Amount allotted from appropriation by river and harbor act approved March 3, 1909	10,000.00
	11,770.67
June 30, 1909, amount expended during fiscal year, for works of improvement	1,770.67
July 1, 1909, balance unexpended	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

NORTHWEST FORK (MARSHYHOPE CREEK), NANTICOKE RIVER, MARYLAND.

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 869, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., March 2, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

The district officer presents two plans for improving the Northwest Fork of Nanticoke River above Brown's wharf, with a view to providing a channel 60 feet wide at bottom and 6 feet deep at mean low water, with a turning basin at the upper end. In plan 1 it is proposed to locate the upper terminus of the improvement at a point a little more than one-half mile below the south boundary line of the town of Federalsburg, where a public landing can be constructed close to a public highway leading to the town. The cost of this plan is estimated at $44,197.44, and the cost of its maintenance at $2,000 per annum. In plan 2 it is proposed to locate the upper terminus of the improvement immediately at the south boundary line of the town, which would involve an initial expenditure of $55,205.82, and $3,200 per annum for maintenance. It is the opinion of the district officer, for reasons stated in his report, that the improvement of the river in accordance with plan 1 is justified by the commercial and other interests involved.

In order that the merits of this case might receive the fullest consideration, the Board requested that the district officer invite statements from interested parties in regard to the commercial necessity for the improvement. A number of communications were received in response to this invitation, and on March 2, 1908, a hearing was held at the office of the Board, at which a number of persons appeared. From the information presented at the hearing, it appears that certain boats now running on the lower section of the river could utilize the improvement now contemplated at favorable stages of tide without lightering, and that the selection of plan 1, as proposed by the district officer, is entirely satisfactory to the community.

After consideration of all available information affecting this case, the Board concurs with the district officer, and recommends the improvement of the Northwest Fork of the Nanticoke River in the manner contemplated by plan 1, as presented within, at an estimated cost of $44,197.44.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

Federalsburg, which would benefit by an improvement of the stream, is a station on the Cambridge-Seaford branch of the Pennsylvania Railroad, has a population of about 900, and contains 10 stores, 1 bank, 2 flour and grist mills, 1 sawmill and box factory, 1 shirt factory, 1 tin-can factory, and 4 canneries. Below Upper Brown's wharf there are 4 towns and 5 landings with considerable commerce and a channel for navigation 6 feet in depth.

During the year ended April 1, 1907, the commerce of Northwest Fork of Nanticoke River by water was 23,505 tons, valued at $266,250, carried in 1 steamer, 1 gasoline launch, 7 schooners, and 6 lighters, with a loaded draft of from 9½ to 4 feet and an aggregate tonnage of 1,535. This commerce consisted of agricultural products, canned goods, flour, lumber, wood, fertilizers, brick, and general merchandise. The water commerce of Federalsburg was lightered to and from Upper Brown's wharf.

During the same period the commerce by rail was 17,850 tons, valued at $574,225, consisting of agricultural products, coal, charcoal, canned goods, flour, lumber, wood, and general merchandise.

The commerce of Federalsburg by water for the year ended April 1, 1907, was 8,215 tons, valued at $133,400, carried in 6 lighters, averaging a loaded draft of 4 feet, and aggregating a tonnage of 240. By rail the commerce during the same period amounted to 16,675 tons, valued at $547,475.

SUSQUEHANNA RIVER ABOVE AND BELOW HAVRE DE GRACE, MD.

The original governing depth was 5 feet at mean low water. The mean range of tide is 2½ feet. The channel above Havre de Grace was narrow and subject to ice gorges. The original project is dated February 22, 1853, and was for a channel 12 feet deep and 100 feet wide, at an estimated cost of $59,000. Improvements have been in progress since 1853, and up to August 22, 1882, when the existing project was adopted, $97,390 had been expended upon them. The existing project is to give a channel 200 feet wide and 15 feet deep at mean low water below Havre de Grace and to remove the shoal opposite Watsons Island (which is above Havre de Grace) to a depth of 8 feet at the same stage of the tide, at an estimated cost of $168,000. The amount expended on that project to June 30, 1909, is $113,184.42, and has resulted in dredging a portion of the channel below Havre de Grace to a depth of 15 feet at mean low water and removing the shoal opposite Watsons Island, completing about three-fifths of the approved project.

The operations during the year resulted in extending the channel to project dimensions for about 4,000 feet.

The maximum draft that can be carried June 30, 1909, at mean low water over the shoalest part of the channel under improvement is 12 feet. The stream is navigable in fact to Port Deposit, Md., which is about 5 miles above the mouth of the river. The improve-

ment has made no appreciable difference in freight rates. It is proposed to apply funds asked for in continuing work on the project.

Three steamers and 40 sailing vessels and barges are reported as plying in the river, the commerce being valued at $473,933. The tonnage of the river is reported to be as follows: 1905, 135,293; 1906, 73,815; 1907, 85,212, and for 1908, 37,936, consisting of lumber, cement, salt fish, granite, stoves, castings, etc.

July 1, 1908, balance unexpended	$19,969.97
June 30, 1909, amount expended during fiscal year for works of improvement	19,654.39
July 1, 1909, balance unexpended	315.58
Amount (estimated) required for completion of existing project	54,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	54,500.00

WICOMICO RIVER, MARYLAND.

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 569, Sixty-first Congress, second session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., December 28, 1909.

Respectfully returned to the Chief of Engineers, U. S. Army.

The existing project for the Wicomico is for a channel 9 feet in depth to the drawbridge at Salisbury. The present inquiry is for an extension of the channel to the Salisbury mill dam, a distance of about 0.4 of a mile.

The district officer proposes, in connection with the extension of the channel, to dredge a turning basin at its upper end. He estimates the cost of the work involved at $24,000, and not to exceed $600 for annual maintenance. Both the district officer and the division engineer are of opinion that the locality is worthy of improvement to this extent.

It appears that the water-borne commerce of Salisbury now exceeds 100,000 tons annually, and that it may be expected to increase as the territory adjacent develops.

From the facts presented the Board concurs in believing that the improvement as outlined within is advisable, provided that the necessary right of way and an area for the disposition of dredged material be furnished without cost to the General Government. It is therefore recommended that the project for the Wicomico River be modified to include this extension.

In compliance with the provisions of section 13 of the act of March 3, 1909, the Board reports that there are no questions of terminal facilities, waterpower, or other subjects so related to the project proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures made in the interests of navigation.

ANACOSTIA RIVER, DISTRICT OF COLUMBIA.

Before improvement the ruling depth from the mouth to the Navy-Yard Bridge was about 18 feet, the channel affording this depth being narrow and tortuous.

An allotment of $20,000 for work in the Anacostia was made from the appropriation of September 19, 1890, for improving Potomac River at Washington. Under this allotment channels 20 feet deep and about 200 feet wide were dredged through shoals near the foot of South Capitol street and opposite Washington Barracks. This dredging was completed in May, 1892, at a cost of $18,536.94, and the balance, $1,463.06, was applied to the present project.

The present project for this stream was adopted June 13, 1902, and provides for the improvement of the portion of Anacostia River below the Navy-Yard Bridge by dredging a channel 20 feet deep for a width of 400 feet, the depth then gradually decreasing to 6 feet at the bulkhead lines, and by depositing the dredged material on the adjacent flats to an average elevation of 7 feet above low tide, the reclaimed area to be surrounded by an earthen embankment to a height of 14 feet above low tide, protected by a masonry sea wall, and provided with suitable drainage through the embankment, all at an estimated cost of $1,218,525.

The amount expended on the existing project to June 30, 1909, was $267,288.15, of which $6,481.10 was applied to maintenance. As a result of this expenditure, a channel 20 feet deep at mean low water and at least 380 feet wide has been secured for a distance of 9,300 feet upstream from the mouth of the Anacostia, i. e., up to upper limits of the navy-yard. The quantity excavated to date amounts to 1,894,320 cubic yards, in addition to which 214,803 cubic yards has been dredged by other departments of the Government and by private parties under permits from, but without cost to, this office.

A riprap wall has been built to a height of 4 feet above mean low water for a distance of 4,900 feet along the left bulkhead line, and 2,900 linear feet of it has been raised to 5 feet. This wall contains 27,367.1 cubic yards of stone, 4,023.1 cubic yards of which was placed during the fiscal year 1909. It will temporarily serve to retain dredged material and will ultimately form the foundation for the projected masonry sea wall.

Seven hundred and ninety-one piles of the old dismantled wharf opposite the navy-yard have been removed.

Incidental to the improvement of the channel about 150 acres of flats have been filled by the deposit of excavated material to an average height of 5 feet above low tide. Harbor lines have been established from the mouth of the river up to Pennsylvania Avenue Bridge.

The work of improvement for the fiscal year 1909 consisted in channel dredging and work incidental thereto, and amounted to $80,302.37. The work of maintenance for the fiscal year consisted in raising the riprap mounds which had settled, and work incidental thereto, and amounted to $6,481.10.

The entire project is now about 25 per cent completed.

The maximum draft that could be carried on June 30, 1909, over the shoalest part of the locality under improvement was 20 feet. The mean range of tide is about 3 feet.

Anacostia River is navigable for large vessels to the Navy-Yard Bridge, for tugs and small vessels to Pennsylvania Avenue Bridge, and for small scows and lighters to Bladensburg, Md., respectively 2, 2¼, and 8¼ miles above its mouth.

The principal articles of commerce are sand and gravel, naval ordnance and supplies, brick, clay, stone, coal, oils, paving blocks, and cord wood. The receipts and shipments during 1908 amounted to about 283,272 tons, and were estimated to be worth about $4,187,866.

The improvement already made has been of benefit to navigation and has resulted in the diversion of considerable traffic from the

Washington channel, where conditions were rapidly becoming congested. It is not known that any reduction in freight rates has resulted from the work done.

It is proposed to apply the additional appropriation recommended toward dredging, reclaiming the flats, and completion of the project.

The additional work proposed is for the extension of benefits.

Maps of the locality will be found in the Annual Reports of the Chief of Engineers for 1903, 1904, 1905, 1906, and 1909.

Reference to reports upon examinations and surveys of this river will be found on page 198 of the Annual Report of the Chief of Engineers for 1904.

A report relative to the title to Anacostia flats is printed in House Document No. 194, Fifty-ninth Congress, first session.

July 1, 1908, balance unexpended		$97,958.38
Amount allotted from appropriation by river and harbor act approved March 3, 1909		10,000.00
		107,958.38
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$80,302.37	
For maintenance of improvement	6,481.10	
		86,783.47
July 1, 1909, balance unexpended		21,174.91
July 1, 1909, outstanding liabilities		3,936.08
July 1, 1909, balance available		17,238.83
July 1, 1909, amount covered by uncompleted contracts		3,861.34
Amount (estimated) required for completion of existing project		936,543.04
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		230,000.00

POTOMAC RIVER AT WASHINGTON, D. C.

Before improvement the Virginia channel was obstructed by two bars. The upper bar extended upstream from Long Bridge to about one-half mile below Easby Point, and the ruling depth on this bar was 8 feet. The lower bar was near Giesboro Point and had a ruling depth of 14 feet. The ruling depth in the Washington channel was 10 feet. Georgetown Harbor was obstructed by several dangerous rocks. The flats, which extended to the edge of the Virginia channel, were largely bare at low water and were an active agent in spreading malarial and other diseases. In 1849, $1,500 was appropriated for a survey of the river. Of this sum $1,208.61 was expended and the balance of $291.39 covered into the surplus fund of the Treasury.

Between June 11, 1870, and March 3, 1881, the sum of $290,000 was appropriated by Congress for the improvement of the harbors of Washington and Georgetown. The project under which this last-mentioned sum was expended is not definitely stated, although it is understood that it provided for dredging channels 16 feet deep and 200 feet wide through the Georgetown and Washington channels, and for the removal of the most dangerous rocks obstructing navigation in the harbor of Georgetown to a depth of 20 feet.

The existing project for the improvement was adopted August 2, 1882, and has for its object the improvement of the navigation of the river by widening and deepening its channels, the reclamation of the flats by depositing on them the material dredged from the channels, the freeing of the Washington channel of sewage, and the establishment of harbor lines. To effect these, the project provided "that the channel depths * * * should be sufficient to accommodate the largest draft vessels that can be brought up to Arsenal Point" (the projected depth was not stated in feet, but by the above-imposed condition was at that time limited to 20 feet at low tide, whereas the ruling depth in the Potomac River below Washington has now been increased by dredging to 24 feet at low tide), that the flats be reclaimed to a height of 3 feet above the flood plane of 1877 (which, although the highest recorded freshet at that time, was exceeded by about 3 feet by the flood of 1889), and for a tidal reservoir to be provided with automatic inlet and outlet gates. A training dike on the Virginia shore extending downstream from Analostan Island was added to the project in 1890. The project also provided for the rebuilding of Long Bridge and for the interception of all sewage discharged into the Washington channel, but neither of these works was included in the estimated cost of the improvement, which was $2,716,365. The estimate as revised in 1897 is $2,953,020.

The amount expended on the work of the existing project to June 30, 1909, was $2,758,564.56, of which $475,356.81 has been applied to maintenance since March 3, 1899. The following sums have been obtained from other sources than appropriations: Received from sale of blueprints, 50 cents; of condemned property, $212.83; total, $213.33.

The expenditure resulted in the dredging of a channel 20 feet deep and 550 feet wide through the bar above Long Bridge, in increasing the width of the natural channel just below Long Bridge by 50 to 500 feet, and in deepening it to 20 feet; in dredging a channel 350 feet wide and 20 feet deep through the bar in the Virginia channel near Giesboro Point; in dredging the Washington channel to a width of 400 feet and a depth of 20 feet; in dredging between this navigation channel and the wall of the adjacent reclaimed area to a depth of 12 feet; in dredging at the junction of the Washington and Virginia channels; in dredging the tidal reservoir (111 acres) to a depth of about 8 feet, and restoring this depth to its area; in several times redredging cuts 20 feet deep through bars which had re-formed by freshet action in the Virginia and Washington channels; in the completion of and repairs to the reservoir outlet; in the construction of about 98 per cent of the combined inlet gates and bridge for the tidal reservoir; in the construction of 35,289 linear feet of sea wall, of which 8,876 linear feet has been taken down and relaid; and in the building of 5,965 linear feet of training dike, containing about 21,218 cubic yards of stone.

The area of land reclaimed by these operations is 628 acres (or, including reservoir, 739 acres), which, by act of March 3, 1897, was declared to be a public park, under the name of "Potomac Park."

The amount of material dredged, deposited on the park, and paid for under the various contracts is about 13,893,756 cubic yards. It is estimated that in addition about 3,000,000 cubic yards of material have been dredged under contract and deposited on the park, but

not paid for, owing to its having been excavated outside the specified limits.

In addition to the foregoing, a large amount, estimated at 915,000 cubic yards, of clean desirable earth has been deposited upon the park by private parties working under permits.

The entire project is now about 90 per cent completed.

The work of maintenance during the year consisted in finishing the dredging in the Virginia channel and tidal reservoir, in making additions and repairs to sea wall, in care of property, and in repairs to plant, etc., and in general maintenance of the improvement.

The work on the project during the year consisted in continuing the building of the combined inlet gates and bridge for the reservoir.

The project for the improvement of the Potomac River at Washington provides for a flushing basin, with automatic gates at the inlet and outlet, so arranged that at each oscillation of the tide the basin or tidal reservoir will be filled during flood tide from the Virginia channel and emptied to the level of low water during the ebb tide into the Washington channel.

In order to provide for a highway connecting the park drives on each side of the inlet to the tidal reservoir, an appropriation of $25,000 was made by act of Congress approved May 27, 1908 (sundry civil appropriation act), to defray the additional expense involved in widening the proposed inlet gates and constructing a road across them.

The plans provide for a structure with automatic gates to close during the ebb and open during the flood tide, with curtain gates to be closed when the Potomac River is heavily charged with sediment, with a lock for the passage of small water craft, and with a park highway over the top. The structure will rest upon a pile foundation and will be of concrete or reinforced concrete throughout. A consulting architect has been employed to design the ornamental features, and a consulting mechanical engineer to assist in the design of the gates and operating machinery.

During the fiscal year 1908 preliminary surveys and current observations were made, general plans were prepared and approved by the Chief of Engineers, nearly all of the necessary construction plant was prepared and erected, the entire foundation was dredged, and about one-third of the bearing piles were driven.

During the present fiscal year the remaining foundation piles were driven, the foundation surrounded by a wooden sheet-pile cofferdam, and concrete piers and superstructure carried up to its present condition. Excluding the installation of the automatic curtain and lock gates, the bridge is estimated to be 98 per cent completed.

The furnishing and emplacing of piles was done under a formal contract, and a contract is in force for the furnishing and installation of lock and curtain gates.

All other construction has been done by day labor under the direction of this office, materials being purchased in accordance with regulations.

In addition to $25,000 appropriated by the sundry civil act, approved May 27, 1908, there has been expended from the appropriation for improving Potomac River, approved March 2, 1907, for the construction of the combined bridge and inlet gates $81,382.77, which

includes the cost of the relocation and construction of 380 feet of sea wall. Two hundred and ninety additional feet of sea wall formerly laid up dry were reconstructed and laid up in mortar.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the Washington channel was 21 feet. For the Virginia channel it was 18 feet. The mean range of tide is about 3 feet.

The Potomac River is navigable to the foot of Little Falls, 3½ miles above Georgetown, but the Aqueduct Bridge, which crosses the river at Georgetown, 113 miles above the mouth of the river, has no draw and limits the navigation of large steamers and masted vessels.

The principal articles of commerce are sand and gravel, coal, lumber, ice, cord wood, stone, oils, oysters, bricks, coke, and general merchandise. The receipts and shipments during 1908 amounted to about 760,737 tons and were estimated to be worth about $7,843,130.

The benefits to navigation from the improvement made have been marked. Vessels of much deeper draft than those formerly used are now engaged in this trade, and it is understood that freight rates have been materially reduced.

It is proposed to apply the funds on hand and the additional appropriation recommended toward completion of the tidal gates, reconstruction of about 10,000 linear feet of damaged sea wall, dredging in the Washington channel, and prosecution of the project.

The additional work proposed is for the purpose of extension of benefits and for the maintenance of the improvement in a serviceable condition.

IMPROVING POTOMAC RIVER.

July 1, 1908, balance unexpended		$192,970.99
Amount allotted from appropriation by river and harbor act approved March 3, 1909		25,000.00
Received from sale of condemned property		123.80
		218,094.79
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$67,589.65	
For maintenance of improvement	91,856.37	
		159,446.02
July 1, 1909, balance unexpended		58,648.77
July 1, 1909, outstanding liabilities		5,353.38
July 1, 1909, balance available		53,295.39
July 1, 1909, amount covered by uncompleted contracts		13,924.27
Amount (estimated) required for completion of existing project		611,376.81
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		180,000.00

POTOMAC RIVER BELOW WASHINGTON, D. C.

Report on a recent survey is printed in House Document No. 859, Sixtieth Congress, first session. Following is the letter of the Chief of Engineers submitting it:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, April 10, 1908.

SIR: I have the honor to submit herewith, for transmission to Congress, reports of August 12, 1907, and January 24, 1908, with map, by Maj. Spencer Cosby, Corps of

Engineers, on preliminary examination and survey, respectively, as authorized by the river and harbor act approved March 2, 1907, of Potomac River below Washington, D. C., with a view to obtaining a width of channel of 400 feet.

In 1890, prior to improvement, it was reported that at best only about 18 feet at mean low water could be carried with safety over certain shoal spots in the channel below Washington. There has since been secured, by dredging, an unobstructed channel at least 200 feet wide and 24 feet deep at mean low tide from just below Washington to the mouth of the river. It is now estimated that it will cost $204,000 to increase the width of this 24-foot channel to 400 feet; maintenance of the completed channel is estimated to cost at the rate of $2,500 annually.

It is the opinion of the district officer, concurred in by the division engineer and the Board of Engineers for Rivers and Harbors, that this locality is worthy of improvement in the manner proposed, but that the widening of the channel below Washington should not be undertaken until an increase in depth to 24 feet in the channels of either or both of the Potomac and Anacostia rivers at Washington has been definitely provided for by Congress.

The existing project depth for the Potomac and Anacostia rivers at Washington is 20 feet at mean low water. The mean range of tide is about 3 feet. It appearing to be desirable that the larger commercial and naval vessels which are able to leave the docks at high water should be permitted to proceed through the hundred miles of river channel without regard to the tide, and it appearing also that the existing 200-foot channel is too narrow for vessels to be easily navigated at speed, or for boats to pass at night and in bad weather, I am constrained to differ from the opinion expressed in the accompanying reports and to recommend that the plan of improvement presented receive favorable consideration by Congress under present conditions and without waiting for additional depth in the harbor proper.

Very respectfully,

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

The principal articles of commerce carried on the lower Potomac are sand, gravel, coal, lumber, ice, oils, naval ordnance and supplies, cordwood, brick clay, stone, fertilizer, oysters, bricks, phosphate rock, coke, paving blocks, railroad ties, asphalt, potash salt, and general merchandise. The receipts and shipments during 1906 amounted to about 1,284,000 tons and were estimated to be worth about $20,000,000.

The above is exclusive of the freight shipped on ferryboats between Washington and Alexandria, which is estimated at 15,000 tons annually. The passenger trade is also considerable.

The trade is carried on principally with Baltimore, Norfolk, New York, Boston, Maine ports, Nova Scotia, and Florida, though there is some commerce with Brazil, Argentina, Spain, and the West India Islands.

Excluding the ferryboats and local passenger and excursion steamers, the total number of arrivals of vessels in the river during 1906 was about 8,600, of which about 600 drew over 16 feet; the majority of the latter drew from 19 to 22 feet.

POTOMAC RIVER AT ALEXANDRIA, VA.

Report on a recent survey is printed in House Document No. 1253, Sixtieth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 18, 1908.

SIR: I have the honor to submit herewith, for transmission to Congress, reports of July 26, 1907, and October 14, 1908, with map, by Maj. Spencer Cosby, Corps of Engineers, on preliminary examination and survey, respectively, provided for by

the river and harbor act of March 2, 1907, of Potomac River at Alexandria, Va., with a view to the removal of a bar recently formed.

Work of improving Potomac River has secured a channel 24 feet deep and 200 feet wide through all shoal places obstructing 24-foot navigation below Washington, D. C. The estimated cost of the dredging necessary to afford a depth of 24 feet at mean low water over the area in front of the city of Alexandria, between deep water of the through channel and a line drawn 20 feet outside of a proposed pierhead line, is $116,000, with an additional charge of about $2,000 a year for maintenance, and, in the opinion of the local officer, this improvement is worthy of being undertaken by the General Government.

In his indorsement of November 18, 1908, on the subject, the division engineer, Col. D. W. Lockwood, Corps of Engineers, recommends dredging to the depth of 24 feet in front of the existing wharves only.

The matter has been referred, as required by law, for consideration by the Board of Engineers for Rivers and Harbors, and attention is respectfully invited to the Board's report of the 1st instant (also herewith), in which it concurs in the opinion of the district officer that the locality is worthy of improvement to the full extent estimated for ($116,000).

The views of the Board meet with the approval of the Chief of Engineers.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

Formerly Alexandria was an important shipping point and ranked with the leading ports of the South. The railroads took away considerable of the business of the harbor, but in the past few years this has been steadily increasing, though the city has never fully regained its former importance as a port.

Statistics of trade for the calendar year 1906 have been carefully compiled by Mr. J. T. Preston, secretary of the chamber of commerce, and are believed to be substantially correct. They show a total of receipts of 190,661 tons, valued at $1,890,545, and a total of shipments of 87,768 tons, valued at $1,226,106, exclusive of the teams and vehicles transported by the Washington and Alexandria ferry line. The principal articles of commerce are coal, fertilizer, glass bottles, ice, lumber, oil, phosphate rock, railroad ties, sand, wholesale groceries, and general merchandise. It is stated that a few years ago Alexandria was the sixth sugar market in the United States.

POTOMAC RIVER AT LOWER CEDAR POINT, MARYLAND.

The following report of the Board of Engineers is concurred in by the Chief of Engineers, and printed in House Document No. 918, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., March 13, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

It is estimated by the district officer that a channel 150 feet wide and 10 feet deep at mean low water can be dredged to Dill's wharf at Lower Cedar Point by way of the "west channel" with a turning basin of the same depth, 300 feet wide and 400 feet long at the wharf, as shown on the accompanying tracing, at a total cost of $13,300. He also estimates that a channel of the same dimensions can be dredged through both the "west channel" and the "southeast channel" with a suitable widening at Dill's wharf, at a total cost of $22,700, but for reasons stated he does not regard the improvement of the "southeast channel" as necessary or warranted at the present time. He is of opinion that the locality is worthy of improvement by the General Government to the extent of dredging the "west channel" in the manner proposed, but in this opinion the division engineer does not concur, believing that frequent work would be required to maintain the improvement.

In its report of October 7, 1907, reviewing that of the district officer on the preliminary examination, the Board explained the commercial conditions which appeared to render this locality worthy of a small expenditure on the part of the General Government. From further inquiry recently instituted by the Board, it seems reasonably certain that the water-borne commerce of the locality will considerably increase if the improvement is executed, and it is probable that Dill's wharf will be put on the regular schedule and made a regular stopping place for the steamers of the Maryland, Delaware and Virginia Railway Company, in addition to steamers of other lines which now call at this point.

From a report on a survey of another portion of the Potomac River, submitted subsequent to the within report and therefore not available to the division engineer when reviewing the case now under consideration, it appears that a lateral channel excavated a number of years ago through less stable material, and in a more exposed position, has undergone but little deterioration, and the Board is therefore led to believe that the cost of maintaining the channel to Lower Cedar Point will not be excessive. After consideration of all the facts available in this case, the Board recommends the improvement of the "west channel" in the manner proposed by the district officer, at a total cost of $13,300.

For the Board:

R. L. HOXIE,
Colonel, Corps of Engineers,
Senior Member Present.

The principal articles of commerce are fish, farm produce, fertilizer, lumber, live stock, grain, tobacco, flour, and general merchandise. During 1906 the receipts and shipments by water amounted to about 3,400 tons and were estimated to be worth about $136,000. Considerable quantities of fish and produce are brought to this wharf by small boats from the Virginia shore of Potomac River, opposite Lower Cedar Point, to be shipped on the steamers and large vessels.

At least two-thirds of the agricultural produce goes by railroad at present, and at much higher rates.

POTOMAC RIVER AT MOUNT VERNON, VA.

The following report of the Board of Engineers on a recent survey is printed in House Document No. 654, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., January 18, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

In the within report it is estimated that the channel leading to the wharf at Mount Vernon can be dredged to a width of 150 feet and a depth of 10 feet, and a suitable turning basin excavated at its inner end, at a total cost of $11,000.

From the history of the improvement of this locality contained in the district officer's report on the preliminary examination it appears that the original project of 1879 had in view the construction of a channel 150 feet wide and from 6 to 7 feet deep between the main channel of the Potomac River and the Mount Vernon wharf, with a turning basin at the wharf having a radius of 150 feet. This project was modified in 1888 to provide a channel width of 200 feet and a depth of 9 to 10 feet, with a turning basin having a radius of 200 feet. Operations under this project continued until May, 1891, when a channel suitable to the needs of navigation, though somewhat less than the project dimensions, had been completed. The present survey indicates that there has been no appreciable impairment of the depth last obtained, but the channel has narrowed to a width of 40 to 60 feet.

It is acknowledged by persons interested in the improvement of this channel that the locality has no commercial importance, and the work is urged solely on account of the patriotic and historical associations which have constituted Mount Vernon a place of unusual public interest. Throughout a period of nearly fifty years the Mount Vernon Ladies' Association has endeavored to maintain the buildings and grounds in proper condition, and in this task it has deemed it essential to exercise certain restrictions calculated to prevent the indiscriminate use of the wharf and grounds. The district officer invites attention particularly to the fact that the association some years ago entered into an agreement with a steamboat company, by which that company was granted for a certain period the exclusive right to land passengers at the wharf. For this reason he believes that the owners of the only steamer which has use of the channel should bear the expense of opening up and maintaining it, and he therefore

concludes that as long as existing conditions continue the channel is not worthy of further improvement by the General Government.

The Board recognizes the fact that if the merits of this case were measured according to the standards generally applied to proposed river and harbor works the locality could not be considered worthy of improvement, but in recommending the survey which is reported upon within, the Board gave special weight to the peculiar conditions which affect this case and which have heretofore been considered sufficient reason for the improvement of the locality by the United States. Congress having already determined that these conditions merit recognition, without regard to commercial considerations, it seemed desirable that the cost of rehabilitating the channel to its former condition of usefulness should be ascertained in order that definite action with that end in view might be taken if deemed advisable.

In view of the facts briefly stated above, the Board concurs with the division engineer in the opinion that the advisability of undertaking further work on the channel to the wharf at Mount Vernon is a question for the decision of Congress, which will now have all the pertinent facts before it.

For the Board:

R. L. HOXIE,
Colonel, Corps of Engineers,
Senior Member Present.

HARBOR AT CAPE CHARLES CITY, VA.

The harbor proper is land-locked and covers an area of 10 acres, and it and the exposed channels leading thereto had, before the beginning of the work, a depth of 12 feet at mean low water.

The project was adopted in 1890 and requires the dredging of a channel through Cherrystone Inlet and bar 100 and 200 feet wide, respectively, and 16 feet deep at mean low water, the dredging of an entrance channel 100 feet wide of the same depth, and dredging over the entire area of the protected and inclosed harbor to a depth of 14 feet at mean low water. Jetties of stone were to be constructed for the protection of the channel leading into the basin. This work was estimated to cost $142,340.

The expenditures to June 30, 1909, amounted to $119,033.71, and resulted in the dredging and redredging of one-half of the inner harbor to the proper depth and the excavation of channels of the required dimensions through the inlet and the entrance to the basin and the construction of 875 feet of the north jetty and 232 feet of the south jetty. The north jetty is 1,625 feet in length, but 750 feet of this was built without expense to the United States. Of the amount expended, $13,360.16 was applied to maintenance. The project is about 85 per cent completed.

On June 30, 1909, a vessel drawing 12 feet could enter the harbor at mean low water. The docks within the landlocked harbor are about 3 miles from the 16-foot contour in Chesapeake Bay at Cherrystone bar. The range of the tide is about 2.5 feet.

The commerce consists mainly of miscellaneous freight, agricultural products, fertilizer, and some oysters and fish. At the beginning of the improvement the annual commerce was about 400,000 tons. For the calendar year 1908 it is reported to have amounted to 1,811,731 tons, valued at $45,293,275. It has not been found practicable to ascertain what effect, if any, the improvement has had upon freight rates.

The available balance and amounts estimated for will be applied to dredging under the adopted project, and in maintaining the improvement for the benefit of existing commerce.

July 1, 1908, balance unexpended		$30,401.11
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$11,074.66	
For maintenance of improvement	13,360.16	
		24,434.82
July 1, 1909, balance unexpended		5,966.29
Amount (estimated) required for completion of existing project		30,700.16
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		25,000.00

HARBOR AT MILFORD HAVEN, VIRGINIA.

Milford Haven is a tidal estuary of Chesapeake Bay, about 4 miles long and from one-half to 1 mile wide. The depth in the channel ranges from 6½ to 15 feet, and in the portion navigated by steamers is generally 9 feet or more. The haven has two entrances, one at the northwest end from Hills Bay, an arm of Piankatank River, and another at the southeast end, from Chesapeake Bay. Both entrances are obstructed by bars. The southeast entrance is exposed, and as the bar has a ruling depth of but 3 feet is seldom used. The bar which obstructed the northwest entrance had, before improvement, a ruling depth of 8 feet. A bar also existed within the haven between Cricket Hill and Callis wharves, with a ruling depth of about 8 feet.

The project for this improvement, adopted March 3, 1899, and modified in 1902, provides for securing channels 10 feet deep by a minimum width of 200 feet through both bars, viz, at the northwest entrance and between Cricket Hill and Callis wharves, at an estimated cost of $17,500.

The amount expended to June 30, 1909, was $20,475.16, $113.65 of which was applied to maintenance. The sum of $3,032.97 was recovered as judgment from a failing contractor. As a result of this expenditure channels of the full projected dimensions have been dredged through both bars, and a jetty 333 feet long has been constructed to maintain the outer channel.

For reasons given in his report herewith (Appendix K 9) the district officer recommends that the existing jetty be extended about 800 feet at an estimated additional cost of $10,000, as an aid in maintaining the dredged channels. This recommendation is concurred in by the Board of Engineers for Rivers and Harbors and by the Chief of Engineers.

The maximum draft that could be carried June 30, 1909, at mean low tide over the shoalest part of the locality under improvement was 10 feet. The mean range of tide is about 1.3 feet. The haven is navigable throughout its entire length by vessels drawing 6 feet, and Fitchett's wharf, about 3 miles above the northwest entrance, is the highest point reached by the large steamers.

The principal articles of commerce are oysters, fish, crabs, farm produce, fertilizers, piles, hay and feedstuffs, lumber, building materials, flour, ice, and general merchandise. The receipts and shipments during 1908 amounted to about 32,570 tons, and were estimated to be worth about $908,600.

The work done has been of considerable benefit to commerce and navigation. Freight rates have, however, been advanced.

It is proposed to apply the additional appropriation recommended to the maintenance of the completed channels of the project by dredging.

The additional work proposed is for the purpose of extension of benefits and maintenance of the work already done. It is anticipated that an appropriation of about $4,000 every eight years will be required for maintenance.

July 1, 1908, balance unexpended		$171.46
June 30, 1909, amount expended during fiscal year:		
Carried to surplus fund	$57.81	
For maintenance of improvement	113.65	
		171.46
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement		[a] 3,000.00

HARBOR AT NORFOLK AND ITS APPROACHES, VIRGINIA.

(*a*) *General improvement.*—In its original condition the main channel of this harbor was at mean low water navigable by vessels of 20 feet draft as far as the navy-yard, on the Southern Branch of the Elizabeth River, while in the Eastern Branch of this river there was a channel 15 feet in depth at mean low water as far as the Campostella bridge. These channels were of varying width.

The original project of improvement was adopted in 1878, revised in 1885, and amended in 1890, 1898, and 1905. It included the attainment of a channel from 500 to 700 feet wide and 25 feet deep at mean low water from Hampton Roads to the navy-yard, a branch channel 22 feet deep at the same stage of the tide to the Campostella bridge on the Eastern Branch, and, within the limits of the first-named channel, a channel 450 feet wide and 28 feet deep at mean low water from deep water in Hampton Roads to the navy-yard. There has also been included in the project the excavation of an anchorage at the mouth of the Western Branch, having an area of 56 acres and a depth of 25 feet at mean low water, and the dredging, to the depth of 28 feet at mean low water, of the area between the western edge of the main channel and a line 75 feet outside of the established pierhead line, along the railroad docks at Pinner Point. The cost of all this work was estimated at $1,623,790.98.

The existing project of improvement is the original project modified from time to time as stated above, under which the first appropriation for work was made August 14, 1876.

To June 30, 1909, there had been expended on this existing project $1,669,862.63, of which sum $51,052.16 was for work of maintenance. The sum of $24.71 has been derived from the sale of property and blueprints.

The amount expended during the fiscal year was in payment of outstanding liabilities due for new work at the close of the fiscal year 1908, and for expenses of an examination made of the area dredged in that fiscal year.

On June 30, 1909, the project is about 99.5 per cent completed, the only work remaining to be done being the dredging of a strip 20 feet wide and 2,600 feet long from the south side of the channel in the Eastern Branch between the Norfolk and Western Railroad and

[a] In addition to this amount the sum of $10,000 could be profitably expended in extending the jetty, if authorized by Congress.

Campostella highway bridges, for which purpose the estimate for completion has been increased by $5,000.

On June 30, 1909, the main channel of the harbor was available at mean low water for vessels of 28 feet draft as far as the navy-yard, which is located about 10 miles from deep water in Hampton Roads. The Eastern Branch channel is available at mean low water for vessels drawing 22 feet as far as the Campostella bridge, about 11 miles from deep water in Hampton Roads. The normal range of the tide is 2.7 feet.

The Southern Branch of the Elizabeth River is navigable as far as the Albemarle and Chesapeake Canal locks, a distance of about 11 miles above the confluence of the Eastern and Southern branches of this river. The Eastern Branch is navigable for about 5 miles above this confluence. From this confluence to deep water in Hampton Roads the distance by the main river is about 9 miles.

For the calendar year 1908 the water-borne shipments aggregated about 11,746,746 tons, valued at about $843,563,326. The chief products handled are coal, cotton, fertilizer, lumber, and agricultural products. The improvement has made Norfolk an important shipping point for bituminous coal from the West Virginia fields, and a new railroad, the Virginian, recently completed, commenced loading cargo and bunker coal at its pier on the Elizabeth River in April last.

It has not been found practicable to ascertain what effects, if any, the improvement has had on freight rates.

The amount estimated as a profitable expenditure for the fiscal year ending June 30, 1911, will be applied in removing a small shoal west of the Norfolk and Western Railway bridge across the Eastern Branch, and in completing the project by dredging between the Norfolk and Western Railway and Campostella bridges.

For more extended information and maps, see Reports of Chief of Engineers for 1880, page 815; 1885, page 1018; 1887, page 969; and 1893, page 1323. For reference to examinations and surveys, see Report of Chief of Engineers for 1906, page 238.

July 1, 1908, balance unexpended	$3,863.38
Received from sales during fiscal year	3.50
	3,866.88
June 30, 1909, amount expended during fiscal year, for works of improvement	3,863.38
July 1, 1909, balance unexpended	3.50
Amount (estimated) required for completion of existing project	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	10,000.00

(*b*) *Hospital Point.*—The land of this point is the property of the United States, and a part of the grounds used by the Navy Department as a site for a hospital. The main channel of Norfolk Harbor passes in front of and close to this harbor.

The project for this work, adopted in 1902, required the cutting off of 450 feet of the point, the construction of a sea wall and wharf, and the dredging of the area on both sides of the old point. The depth to be secured in the dredging was to be the same as that of the harbor—25 feet at mean low water. The estimated cost of the work was $193,957, all of which has been appropriated.

On June 30, 1909, the expenditures had amounted to $193,957, and had resulted in the completion of the project. Of the amount expended, $6,392.39 was applied toward maintaining the project depth.

During the fiscal year dredging was done over a portion of the shoaled area south of the point.

The amount required in the fiscal year 1911 will be applied to dredging the balance of the shoaled area to the project depth.

The statements in the previous section of this report regarding the character and volume of the commerce affected by the improvement of Norfolk Harbor, and as to the tidal range, state of navigability of the harbor, and the effect of the improvement on freight rates, apply to this section also.

July 1, 1908, balance unexpended	$6,392.39
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	6,392.39
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement	5,000.00

NORFOLK HARBOR AND NEWPORT NEWS, VA.

Report on a recent survey is printed in House Document No. 551, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, January 14, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports (with maps), dated June 18, 1909, by Maj. Joseph E. Kuhn, Corps of Engineers, and December 7, 1909, by Maj. Mason M. Patrick, Corps of Engineers, on preliminary examination and survey, respectively, of Norfolk Harbor, Virginia, and the approaches thereto, with a view to obtaining a depth of 35 feet and suitable width from deep water in the sea via Elizabeth River and the Southern Branch to the navy-yard; also between Lamberts Point and Pinners Point, with a view to providing additional anchorage area abreast of and above Lamberts Point; also the Southern Branch of the Elizabeth River above the navy-yard, called for by the river and harbor act approved March 3, 1909.

As the scope of this examination covers three distinct subjects, it is thought most convenient to treat them separately.

Norfolk Harbor and the approaches thereto, with a view to obtaining a depth of 35 feet and suitable width from deep water in the sea via Elizabeth River and the Southern Branch to the navy-yard.—This harbor is now being improved under a project adopted in the river and harbor act approved March 2, 1907, which contemplates a channel 30 feet deep at mean low water from deep water in Hampton Roads to the junction of the Southern and Eastern branches of Elizabeth River. Between Hampton Roads and Lamberts Point the channel is to have a width of 600 feet, and above Lamberts Point the width is to be 800 feet.

The district officer states that the commerce of Norfolk is large and certain to increase and while much of it is carried in vessels of moderate draft, for most of which the facilities, so far as depth of channel is concerned, are ample, there are boats calling at this harbor which can not load to their full capacity because of insufficient channel depths, and he is of opinion that the present and future importance of this harbor and the needs of its prospective commerce warrant a revision of the existing project. Owing to the limitations of the law, the 30-foot channel will end at the junction of the Southern and Eastern branches of the Elizabeth River, and the channel to the navy-yard, which extends a little over a mile up the Southern Branch, will have a depth of only 28 feet at mean low water, which is clearly insufficient for the needs of the navy-yard, as it will not accommodate the largest battle ships now in commission.

To secure a channel 35 feet deep and 400 feet wide at mean low water from the navy-yard to deep water in Hampton Roads will necessitate the removal of 6,040,000 cubic yards of material, at an estimated cost of $800,000. Any plans for increasing the channel depth to 35 feet at low water in Norfolk Harbor and its approaches from deep water

in the sea must necessarily involve the deepening of the entrance channel near Thimble Shoal light correspondingly, and this will necessitate the removal of approximately 3,000,000 cubic yards of material, at an estimated cost of $660,000.

The district officer is of opinion that this improvement is worthy of being undertaken by the General Government, and in this opinion the division engineer concurs, but he thinks that its execution might properly be deferred and await the accomplishment of other projects which are more pressing.

Between Lamberts Point and Pinners Point, with a view to providing additional anchorage area abreast of and above Lamberts Point.—In the opinion of the district officer the removal of the shoal abreast of Lamberts Point, an area of approximately 22 acres, with a present depth of not more than 20 feet, will provide increased anchorage area at a point where numerous collisions and groundings have occurred, and is a work worthy of being undertaken by the General Government. This work will necessitate the removal of about 220,000 cubic yards of material to provide a depth of 30 feet, at a cost of about $30,000. The division engineer considers this proposition questionable, as similar work in other localities is being done by local interests at their own expense.

The Southern Branch of the Elizabeth River above the navy-yard.—Along the Southern Branch above the navy-yard there has been considerable development since the last investigation was made of this locality in compliance with the river and harbor act of March 3, 1905. (See H. Doc. No. 373, 59th Cong., 1st sess.) The district officer reports that several industrial plants have recently located along this part of the river, and he proposes dredging a channel 25 feet deep and 300 feet wide to the line A–B on the accompanying map, and thence 22 feet deep and 200 feet wide to the Norfolk and Western Railway bridge, at a total cost of $222,500. The division engineer is of opinion, since this is largely a work designated for the development of an inner harbor in order to afford an increase in available factory sites, that local interests should contribute one-half of the cost of executing the project and maintaining it thereafter.

These reports have been referred to the Board of Engineers for Rivers and Harbors for examination and review, as required by law, and after full consideration the Board recommends that the project for the improvement of Norfolk Harbor be modified to include all of the work proposed by the district officer at a total cost of $1,712,500, as follows:

Channel 35 feet deep and 400 feet wide at mean low water, from deep water in Hampton Roads to the navy-yard	$800,000
The estimated cost of annual maintenance for this section is	40,000
Removal of shoal in entrance channel near Thimble Shoal light to a depth of 35 feet and width of 500 feet	660,000
The estimated cost of annual maintenance for this section is	25,000
Removal of shoal area abreast of Lamberts Point to provide additional anchorage area with depth of 30 feet	30,000
Channel in Southern Branch of Elizabeth River above the navy-yard, 25 feet deep and 300 feet wide to line A–B on map, thence 22 feet deep and 200 feet wide to the Norfolk and Western Railway bridge	222,500
The estimated cost of annual maintenance for this section is	5,000

I concur in the recommendation of the Board of Engineers for Rivers and Harbors.

The district officer has given preliminary consideration to the question of terminals, and states that he propeses to give further study to this matter, and at a later date to submit a report embodying any recommendations which it may then seem well to make. There are no questions of water power involved at this locality, and, in my opinion, there are not any other subjects so related to the project herein recommended that they could be advantageously coordinated therewith in the interests of navigation.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

For summary of House Document No. 550, Sixty-first Congress, second session, see Appendix.

APPOMATTOX RIVER, VIRGINIA.

(*a*) *General improvement.*—The original project, which is also the existing project, was adopted in 1871 and revised in 1893. The project as revised covers the attainment and maintenance of a channel 80 feet wide and 12 feet deep at mean high water between Point

of Rocks and Petersburg. The cost of providing this channel was estimated at $471,920 and its maintenance at $10,000 annually.

On June 30, 1909, the sum of $465,288.76 had been expended toward the improvement and the sum of $52,434.97 for maintenance.

The amount reported as expended during the fiscal year was applied to improving by dredging the channel between Petersburg and a point about 4½ miles below and in maintaining the channel by removing shoals formed by the freshet of 1908. The project is about completed and future work will be toward maintenance.

At the present time the channel of the river is available at high water for vessels of about 9 feet draft, the normal range of the tide being about 2.6 feet. The head of navigation is Petersburg, Va., about 11 miles from the mouth of the river.

The commerce consists of lumber and miscellaneous products. In 1890 it amounted to about 20,000 tons. It gradually increased until in 1900 and 1901 it amounted to about 150,000 tons. Since then it has decreased, and for the calendar year 1908 it is reported to have been 31,830 tons.

It is proposed to expend the balance now available in removing material brought down by freshets and deposited in the navigable channel of the river. This work is required to render the navigable channel available in the interests of commerce. Work will be commenced early in the next fiscal year, a contract having been awarded for the work.

The amount estimated as a profitable expenditure for the fiscal year ending June 30, 1911, will be applied toward the removal of material deposited in the navigable channel by freshets, for the purpose of maintaining the improvement.

July 1, 1908, balance unexpended		$49,192.23
Amount allotted from appropriation by river and harbor act approved March 3, 1909		5,000.00
Amount allotted from appropriation for emergencies in river and harbor works, act of March 2, 1907		10,000.00
		64,192.23
June 30, 1909, amount expended during fiscal year:		
For maintenance of improvement	$43,917.66	
Repaid to appropriation for emergencies in river and harbor works	6,800.00	
		50,717.66
July 1, 1909, balance unexpended		13,474.57
July 1, 1909, outstanding liabilities		3,171.55
July 1, 1909, balance available		10,303.02
July 1, 1909, amount covered by uncompleted contracts		4,633.65
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		5,000.00

(*b*) *At Petersburg.*—The project for the work contemplated is not to provide a navigable channel, but to excavate a new channel into which to deflect the river, and thus overcome the trouble experienced by the deposit of sediment in the navigable channel of the river in the neighborhood of Petersburg.

The project for this work, which was adopted June 13, 1902, contemplates the excavation to mean low water of a cut from 200 to 300

feet wide and 2½ miles long and the diversion of the river into the said cut by means of a dam built across the present channel at the head of the harbor of Petersburg, and includes the construction of bridges for the highways and railway crossing the new channel and other incidental work. The estimate for the work was $200,000, which amount has been provided.

The river and harbor act of March 3, 1909, authorized a contract for the completion of the diversion work at a cost of $60,000, yet to be appropriated.

At the close of the fiscal year 1909 the sum of $186,199.88 had been expended, all of the land needed has been purchased, the highway and railway bridges have been built, the new cut excavated, except where rock was encountered, and the dam across the Appomattox River built to a hight of 9.5 feet above diversion low water. The expenditures during the fiscal year were applied to payment for work done under contract. The project is completed as far as available funds permit.

It has not been found possible to ascertain what effect, if any, the improvement has had upon freight rates.

The balance of funds will be applied to completing the work under the adopted project, provided funds are appropriated for the additional work of excavating rock and earth, revetting banks, raising levee, and raising height of dam. The amount estimated for maintenance will be applied to repairing and revetting levee.

The commerce to be affected by the improvement contemplated is the same as that mentioned in the preceding section, and all general statements made therein apply equally well to this section.

July 1, 1908, balance unexpended		$64,818.41
June 30, 1909, amount expended during fiscal year, for works of improvement		51,018.29
July 1, 1909, balance unexpended		13,800.12
Amount (estimated) required for completion of existing project		60,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, exclusive of the balance unexpended July 1, 1909:		
For works of improvement	$60,000.00	
For maintenance of improvement	5,000.00	
		65,000.00

Following are extracts from House Document No. 952, Sixtieth Congress, first session, relating to a recent survey of this river:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, May 18, 1908.

SIR: I have the honor to submit herewith for transmission to Congress reports of September 25, 1907, and February 5, 1908, by Maj. Joseph E. Kuhn, Corps of Engineers, on examination authorized by item in section 1 of the river and harbor act approved March 2, 1907, of Appomattox River, Virginia, for the purpose of determining what improvements should be made or plan adopted for the maintenance of the channel of said river.

Since 1871 Appomattox River has been under improvement by the United States with a view to obtaining and maintaining a channel with depth of 12 feet at ordinary high water up to the city of Petersburg. In 1902 the dredging project was supplemented by a scheme for diverting the river above the harbor at Petersburg into a former channel in order to relieve the existing navigable channel from carrying the discharge of the river and in this way obviate the shoaling caused by freshets. The latter project is now in course of execution and when completed will leave the existing navigable channel a dead arm of the river, subject only to tidal oscillations and to

discharge of a few small streams on the right bank. Appropriations aggregating $722,998.30 have been made available for both projects by the General Government, in addition to which the city of Petersburg has expended about $600,000, chiefly in dredging.

The further improvement now proposed consists in redredging the present channel to project dimensions, the dredged material to be used in reenforcing the embankment between this channel and the new one, so as to prevent flood waters in the future from breaking through into the present navigable channel and causing further shoaling. The cost of this work is estimated at $23,000 in addition to the funds now on hand and available. After completion of this work it is estimated that an annual expenditure of $3,000 will be required for maintenance.

I concur in the opinion of the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors that Appomattox River is worthy of further improvement to the extent above indicated.

Very respectfully,

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

DYMERS CREEK, VIRGINIA.

Report on a recent survey is printed in House Document No. 325, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, November 11, 1909.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated May 13 and September 20, 1909, by Maj. Jay J. Morrow, Corps of Engineers, on preliminary examination and survey, respectively, authorized by the river and harbor act of March 3, 1909, of Dymers Creek, Virginia, with a view to increasing the depth over the bar at the entrance to 15 feet.

Dymers Creek is a landlocked harbor emptying into Fleets Bay, a tidal estuary of Chesapeake Bay about 3 miles north of the mouth of the Rappahannock River. The present commerce of the stream consists principally of the materials used at the factories and their output, general merchandise, and farm products, amounting in the year 1908 to about 100,000 tons, valued at about $350,000. The depth over the bar at the mouth of the creek is not sufficient to permit of the vessels handling this commerce to pass at all stages of the tide. A project is presented for improvement of the locality by dredging a channel through this obstruction 15 feet deep and 200 feet wide at an estimated cost of $9,000 and an annual cost of maintenance of $500.

I concur in the views of the district officer and the Board of Engineers for Rivers and Harbors that the locality is worthy of improvement by the General Government as proposed.

There are no questions of terminal facilities, development of water power, or any other similar subject which require consideration in connection with the project.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

JAMES RIVER, VIRGINIA.

The original condition of the James, before its improvement by the General Government was begun in 1870, was as follows:

The ruling depth to the lower city line of Richmond was 7 feet at mean low water. This depth obtained on Rocketts reef, immediately below Richmond, and on Richmond bar, 2 miles below. Some 15 miles lower down, in Trents reach, was a shoal on which there was a depth of only 8 feet. This, however, ceased to be an obstruction in January, 1872, when the 5-mile reach in which it was situated was cut off by the opening of Dutch Gap Canal.

In addition to the above natural obstructions there were, in the 10 miles of river below Richmond, wrecks in the channel at Chaffins

Bluff and Graveyard reach, and obstructions placed during the civil war at Warwick bar and Drewry Bluff, consisting at each locality of a military bridge, lines of stone cribs, and sunken vessels. In addition to all these obstructions, the channel between Richmond and Trents reach was in many places narrow and tortuous.

Between Trents reach and City Point, a distance of 18½ miles, the ruling depth was 13 feet, which obtained near Varina or Aikens Landing. Between City Point and the mouth of James River the ruling depth was 15 feet, existing at Harrisons bar and Goose Hill flats, then 43 and 76 miles, respectively, below Richmond.

It was contemplated in the original project, adopted in 1870, to secure a channel having a depth of 18 feet at high tide and a width of 180 feet. The amount expended prior to the adoption of the present project was $763,000, which includes $23,000 appropriated in 1836 and 1852.

The project under which the improvement is now being carried on was adopted July 5, 1884. It provides for the formation by means of regulation works and excavation of a channel between the mouth of the river and the lower city line of Richmond, having a depth of 22 feet at mean low tide, and a width from the mouth to City Point of 400 feet; thence to Drewry Bluff of 300 feet, and thence to Richmond of 200 feet, at a total estimated cost of $4,500,000.

The act of June 13, 1902, provided for extending the improvement from the lower city line of Richmond to the head of navigation at the docks, at an additional cost of $724,943.15. The work proposed under this extension consists of excavating a channel about 3,300 feet long and 200 feet wide, with a depth of 22 feet at mean low water.

By act of March 3, 1905, the original project was further extended to include the excavation of a turning basin at Richmond by increasing the width of the proposed improved channel to 400 feet for a length of 600 feet, the depth to be 22 feet, at a cost not to exceed $150,000. This makes the total estimated cost of the improvement $5,374,943.15.

The amount expended on the present project to June 30, 1909, was $1,799,033.13, of which $57,799.86, expended subsequent to March 3, 1899, was for maintenance. This item of maintenance includes the cost of dredging sand deposited in the channel by the river during the execution of the work in excess of the quantity originally estimated; also repairs to jetties.

The improvement of the river has been chiefly confined to the upper reaches, where the water was shoalest, and consequently where the greatest benefits to commerce would be obtained. The exceptions to this were the dredging of shoals at Harrisons bar, Swans Point, and Goose Hill flats to a depth of 18 feet.

The project is estimated to be about one-third completed.

The result of the work of improvement is a channel between Hampton Roads and the city wharf at Richmond, Va., having, with few exceptions, a width of not less than 100 feet and a depth of 18 feet at mean low water. The exceptions are Rocklanding shoal, about 89 miles below Richmond, with a depth of 16.1 feet; Dancing Point shoal, about 60 miles below Richmond, with a depth of 16½ feet, and Willis, Varina, and Deep Bottom reaches, about 9 miles, 16 miles, and 18 miles, respectively, below Richmond, the respective ruling depths on which are 16.8, 17, and 17 feet.

The work of maintenance during the year consisted in redredging the channel at Warwick bar, about 4½ miles below Richmond.

The maximum draft that could be carried at low water on June 30, 1909, between the city wharf at Richmond and the mouth of the river was 16.1 feet.

The mean tidal range varies for different parts of the river, being approximately as follows: 2½ feet at Fort Monroe, 1.85 feet at Jamestown, 3 feet at City Point, 3½ feet at Dutch Gap, and 4 feet at Richmond.

The channel length of the James River from Hampton Roads to the head of navigation at Richmond, Va., is 103.8 miles.

It is proposed to apply the available balance of funds to enlarging the channel for about 1½ miles from a point 800 feet below the city line of Richmond, and for some 1,600 feet from a point about 2½ miles below the same line, and to dredging and jetty work at Willis, Kingsland, Varina, and Deep Bottom reaches, situated from about 9 to 18 miles below Richmond.

The appropriation recommended will be applied to maintenance of improvement by dredging; also to enlarging channel between Richmond, Va., and the mouth of Appomattox River, by dredging and extending existing regulation works, excavating a channel through Dancing Point shoal, 300 feet wide by 22 feet deep at low water, and excavating a channel through the south side of Rocklanding shoal, 400 feet wide by 22 feet deep at low water, for the extension of benefits.

The commerce of the river for the calendar year of 1908 amounted to 256,298 tons at Richmond, Va., and 205,970 tons for landings below, or an aggregate of 462,268 tons, a decrease of about 17½ per cent from the tonnage of 1907. The value of the freight transported amounted to $29,329,589.

The decrease in tonnage in 1908 from that of 1907 is, to some extent, attributable to the traffic in the latter year having been increased on account of the Jamestown Exposition.

The principal articles of commerce comprised coal, coal oil, cord wood, lumber, fertilizer, and brick.

The improvement of the river has been beneficial in lowering railroad freight rates and in reducing the cost of river transportation.

GENERAL IMPROVEMENT.

July 1, 1908, balance unexpended		$228,118.75
Amount allotted from appropriation by river and harbor act approved March 3, 1909		10,000.00
		238,118.75
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$140,871.44	
For maintenance of improvement	3,447.94	
		144,319.38
July 1, 1909, balance unexpended		93,799.37
July 1, 1909, outstanding liabilities		1,310.42
July 1, 1909, balance available		92,488.95
July 1, 1909, amount covered by uncompleted contracts		56,129.64
Amount (estimated) required for completion of existing project		3,539,910.51
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		500,000.00

TURNING BASIN.

July 1, 1908, balance unexpended	$329.63
June 30, 1909, amount expended during fiscal year for works of improvement	329.63

NANSEMOND RIVER, VIRGINIA.

The original channel of this stream permitted it to be navigated at mean low water by vessels drawing not more than 5 feet. The depth was increased to 8 feet at the same stage of tide under appropriations made between 1873 and 1878 at a cost of $37,000.

The project under which the work has been carried on until recently was adopted August 11, 1888, and called for a channel 100 feet wide from Suffolk, the head of navigation, to the Western Branch, while from the latter place to Town Point its width was to vary from 200 to 400 feet. The depth to be obtained throughout was 12 feet at mean low water. This improvement was estimated to cost $152,500.

At present it is contemplated to provide a channel only 80 feet wide and 12 feet deep at mean low water between Suffolk and Town Point, which is now deemed ample for the commerce of the stream.

Up to June 30, 1909, the expenditures under the project of 1888 and its modification have amounted to $54,767.71, of which amount $14,090.60 has been applied to maintenance. The channel between Suffolk and the Western Branch has been dredged to 80 feet in width and 12 feet in depth at mean low water, and a turning basin has been excavated at the former place. The project is about 67 per cent completed.

Work on maintaining the channel in the vicinity of the mouth of the Western Branch was done under a contract for dredging in that section of the river during the fiscal year.

At the close of the fiscal year a boat drawing 11 feet at mean low water could reach Suffolk, the head of navigation, 18 miles above the mouth of the river. The tidal variations are about 3 feet at Town Point and 3.8 feet at Suffolk.

The commerce of the stream consists principally of lumber, agricultural products, and merchandise. In 1890 it is reported to have reached about 220,000 tons. For the calendar year 1908 it is reported to have amounted to 132,292 tons, valued at $3,651,525.

It has not been found practicable to ascertain what effect, if any, the improvement has had upon freight rates.

The small balance unexpended and the amount estimated as a profitable expenditure for the fiscal year ending June 30, 1911, will be applied toward maintaining the improvement.

July 1, 1908, balance unexpended	$5,039.84
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	4,807.55
July 1, 1909, balance unexpended	232.29
Amount (estimated) required for completion of existing project	10,269.50
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	5,000.00

NOMINI CREEK, VIRGINIA.

Before improvement the navigation of Nomini Creek, a tributary of the Potomac, was obstructed by a bar at its mouth over which

but 3 feet could be carried at low tide. Except for this bar a draft of 8 feet could be carried to Nomini Ferry, 4 miles above the mouth, and 5 feet could be carried 2 miles farther to the head of navigation.

The project for this improvement, adopted March 3, 1873, and modified in 1879, 1885, 1888, 1890, 1897, and 1908, provides for a channel through the bar 150 feet wide and 9 feet deep, with a jetty about 2,370 feet long at the mouth. The finally revised estimate of cost is $105,000.

The amount expended to June 30, 1909, was $82,686.52, of which $4,008.71 was applied to maintenance subsequent to March 3, 1899. As a result of this expenditure the channel has been dredged to a depth of 9 feet at low tide, with a width of 140 to 150 feet, and redredged, and 2,110 linear feet of jetty has been constructed. The total amount of material dredged from the channel is about 136,000 cubic yards. There have been placed in the jetty about 6,014 cubic yards of stone and 3,000 cubic yards of oyster shells. The entire project is now about 85 per cent completed. No work of maintenance was done during the fiscal year ended June 30, 1909. The work of improvement consisted in the extension of the jetty and miscellaneous office expenses, amounting to $3,757.83.

The maximum draft that could be carried on June 30, 1909, at mean low tide over the shoalest part of the locality under improvement was 9 feet. The mean range of tide is 1.8 feet.

The principal articles of commerce are farm produce, lumber, cord wood, fertilizer, grain, railroad ties, oysters, canned goods, fish, and general merchandise. The receipts and shipments during 1908 amounted to about 22,760 tons and were estimated to be worth about $944,150.

The work done has been of substantial benefit to navigation, and it is understood that freight rates have been considerably reduced and shipments much facilitated.

It is proposed to apply the additional appropriation recommended to the extension and maintenance of the jetty, and redredging the channel to obtain the required width.

The additional work proposed is for the purpose of extension of benefits and for the preservation of the work already done.

A map of the locality may be found in the Annual Report of the Chief of Engineers for 1889.

July 1, 1908, balance unexpended	$71.31
Amount allotted from appropriation by river and harbor act approved March 3, 1909	4,000.00
	4,071.31
June 30, 1909, amount expended during fiscal year, for works of improvement	3,757.83
July 1, 1909, balance unexpended	313.48
July 1, 1909, outstanding liabilities	122.30
July 1, 1909, balance available	191.18
July 1, 1909, amount covered by uncompleted contracts	101.40
Amount (estimated) required for completion of existing project	26,008.71
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	10,000.00

ONANCOCK RIVER, VIRGINIA.

The following report of the Board of Engineers is concurred in by the Chief of Engineers and printed in House Document No. 652, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., January 13, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

The information afforded by the survey reported upon within indicates that the channel dredged in 1893 to a depth of 8 feet and width of 300 feet across the outer bar at the entrance to Onancock River has shoaled to 7 feet, but that the inner bar, which was in the same year dredged to similar depth and a width of 200 feet, has not appreciably deteriorated. The channel which in 1880 and 1881 was dredged through the mud flats near the wharves of Onancock has narrowed somewhat, but the depth originally procured is still available.

The work now proposed by the district officer is the dredging of a channel 200 feet wide and 8 feet deep at mean low water across the outer bar, and the straightening of the river channel, as called for by the act, by cutting off projecting shoals to a depth of 7 feet at mean low water. The estimated cost of this work is $13,500, and the cost of its maintenance $1,000 per annum.

The commercial interests which will be benefited by this improvement are fully explained in the district officer's report on preliminary examination. While the water-borne commerce is not as large as in 1892 and 1893, when the last work of improvement was in progress, its valuation for 1906 is reported at $448,000.

Having in mind the comparatively small cost of the work proposed and its maintenance, and the fact that there now exists a commerce of importance which will probably increase with the provision of better facilities for navigation, the Board concurs with the district officer and the division engineer in the opinion that Onancock River is worthy of further improvement by the United States in the manner and to the extent contemplated by the project presented within.

PAGAN RIVER, VIRGINIA.

Pagan River is a tributary of the James River, entering from the right bank about 7 miles above Hampton Roads. The head of navigation is at Smithfield, about 8 miles from the channel in the James River.

Pagan River is a tidal stream with a normal tidal range of 2.6 feet. The river varies in width from 4,500 feet at the mouth to a little over 100 feet at Smithfield wharves. The navigable channel is narrow at all points, being bordered by extensive tidal flats in the wider parts of the stream. The river banks alternate from side to side between high and well-defined clay banks and marshy areas.

In the first 2 miles of the river below Smithfield are three sharp bends, approximately 90 degrees. These sharp bends, with the existing narrow channel, constitute the chief difficulties in navigation, and concerning which the navigation interests complain.

This waterway is of considerable commercial importance, having a general commerce reported within as amounting to about 117,000 tons, valued at about $7,500,000. Two steamers make regular daily trips between Smithfield, the head of navigation, 8 miles from the mouth, and Norfolk, and these are reported to have a loaded draft of about 8 feet.

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 397, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., October 28, 1907.

Respectfully returned to the Chief of Engineers, U. S. Army.

Based on available data, the district officer submits a plan for improving the navigation of Pagan River by straightening the channel at the bends, at an estimated

cost of $4,600, and states that the improvement can probably be maintained at an expense averaging about $1,000 per year.

Considering the amount and value of the commerce involved, this expenditure seems reasonable, and therefore the Board concurs with the district officer and the division engineer in recommending the adoption of the project proposed within.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

RAPPAHANNOCK RIVER, VIRGINIA.

The lower portion of the Rappahannock River is generally a wide and deep body of water, having the characteristics of a tidal estuary rather than of a fluvial stream.

The obstructions to navigation before improvement was undertaken consisted of 9 bars in the upper portion of the river between Tappahannock and Fredericksburg, over which the ruling depths were from 4 to 10½ feet. Seven of the bars were in the 12½ miles of river below Fredericksburg. Of these bars Fredericksburg bar, with a least depth of 4 feet, and Spottswood bar, 4 miles below Fredericksburg, with a least depth of 6 feet, caused the most delay to steamboats and vessels.

The project for this improvement, adopted March 3, 1871, as modified in 1879 and in 1905, provides for securing a channel 12 feet deep and 100 feet wide between Fredericksburg and Port Royal and 12 feet deep and 200 feet wide between Port Royal and the mouth of the river, this result to be obtained by dredging and the construction of dikes, the latter being also designed to secure the excavated material deposited behind them.

The total estimated cost of the revised project was $363,288.86, exclusive of work properly chargeable to maintenance and estimated in 1905 to cost $38,500. The project on which this estimate was based was adopted by Congress by act approved March 2, 1907. This act authorized an expenditure of $90,000 in excess of the amounts therein and theretofore appropriated. This makes the limit of cost of the revised project $393,633.12, including all necessary work properly chargeable to maintenance on June 30, 1907. The contract authorization of $90,000 has since been appropriated. The estimated annual cost for further maintenance is $10,000.

The amount expended to June 30, 1909, was $464,156.27, of which $100,985.78 has been applied to maintenance since March 3, 1899. The sum of $59,933.18 was expended prior to March 3, 1899, in redredging freshet deposits and in repairs to dikes.

The following sums have been obtained from other sources than appropriations: Damages recovered from contractor's sureties, $1,000, and proceeds of sale of property, $110; total, $1,110. This sum had not been expended at the close of the fiscal year.

The expenditure has resulted in the completed improvement of 13 and in the partial improvement of 7 bars between Fredericksburg and the mouth of the river by means of dredging and rock excavation, construction of dikes, and removal of two wrecks which obstructed navigation. About 1,098,530 cubic yards of material has been dredged, 1,537 cubic yards of rock excavated, 33,495 linear

feet of dikes constructed, 8,290 linear feet of dikes repaired, 915 linear feet of riprap dike constructed, and 1,655.8 cubic yards of riprap stone used.

The entire project is now about 90 per cent completed, but it is estimated that $10,000 per annum is required for maintenance. The work carried on during the year resulted in completing all the dikes called for by the approved project, in completing channels to the full projected dimensions through 13 bars, in partially completing channels through 3 bars, protecting spoil-banks from freshet erosion, and in other miscellaneous work. The incidental expenditure was $65,020.51, of which $14,079.73 was applied to maintenance. Dredging was carried under a continuing contract.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the locality under improvement was about 9 feet. The mean range of tide is about 3 feet. Fredericksburg, 106 miles above the mouth, is the head of navigation for steamers and barges. Falmouth, 3 miles farther up, is the head of navigation for small scows, lighters, and launches.

The principal articles of commerce are railroad ties, lumber, farm produce, grain, cord wood, fertilizers, flour, canned goods, coal, manufactures, and general merchandise. The receipts and shipments during 1908 amounted to about 395,842 tons, and were estimated to be worth about $6,485.797.

The work done has been of benefit to commerce, and it is understood that freight rates have been reduced.

It is proposed to apply the additional appropriation recommended toward the maintenance of dredging, of dike construction, of work already done, and work that will be completed with funds now in hand.

At Fredericksburg bar new deposits of sand are formed by each recurring freshet, and shoaling is also constantly taking place, though less rapidly, at some of the lower bars. This explains the estimate of $10,000 being required annually for maintenance.

July 1, 1908, balance unexpended		$95,203.24
Amount allotted from appropriation by river and harbor act approved March 3, 1909		15,000.00
Amount appropriated by sundry civil act approved March 4, 1909		32,000.00
		142,203.24
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$50,940.78	
For maintenance of improvement	14,079.73	
		65,020.51
July 1, 1909, balance unexpended		77,182.73
July 1, 1909, outstanding liabilities		791.33
July 1, 1909, balance available		76,391.40
July 1, 1909, amount covered by uncompleted contracts		58,403.67
Amount (estimated) required for completion of existing project		7,332.27
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		30,000.00

UPPER MACHODOC CREEK, VIRGINIA.

The following is printed in Rivers and Harbors Committee Document No. 4, Sixty-first Congress, second session:

WAR DEPARTMENT,
BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., December 20, 1909.

SIR: 1. The Board has the honor to submit its report in response to the following resolution of the Committee on Rivers and Harbors of the House of Representatives:

"*Resolved*, That the Board of Engineers for Rivers and Harbors, created by the act of June thirteenth, nineteen hundred and two, be requested to reexamine upper Machodoc Creek, Virginia, with a view to ascertaining whether, by reason of changed conditions or otherwise, the said stream is not now worthy of improvement; and if so, to what extent."

2. In order to secure the necessary information on which to base its report, the Board requested that the district officer be directed to investigate present conditions and submit a report thereon with particular reference to physical or commercial changes, if any, since the date of the last report on preliminary examination, published in House Document No. 136, Fifty-ninth Congress, first session. Such a report has been received, and as it covers the case quite fully it is forwarded herewith as an appendix to this report. In addition to the information thus secured, the Board listened to statements made by interested parties at a hearing given at the request of Hon. C. C. Carlin, M. C., on December 13, 1909.

3. Investigation at the time of the former inquiry indicated that the number of persons likely to be benefited by the improvement was about 500, and the value of the commerce handled was estimated at about $20,000, while it appears from the present report of the district officer and from statements made at the hearing that the benefits expected from the improvement would extend to about 1,000 persons and that the value of present commerce is estimated to amount to $150,000 to $200,000.

4. Estimates have been prepared for a channel 6½ feet deep at low tide and 100 feet wide from the mouth of the creek to Little Ferry and 6 feet deep and 50 feet wide from Little Ferry to Milford Landing. The cost of improving the first reach—mouth to Little Ferry—is estimated at $13,800, with an annual maintenance charge of $800, and for the whole improvement to Milford the estimate is $23,200 and $1,600 annually for maintenance.

5. From a consideration of all the facts and information now available the Board has arrived at the conclusion that this waterway is worthy of improvement from the mouth to Milford Landing, at an estimated cost of $23,200 and $1,600 annually thereafter for maintenance, and that it is advisable for the General Government to undertake the work.

For the Board:
Very respectfully,
W. C. LANGFITT,
Lieut. Col., Corps of Engineers, Senior Member Present

The CHIEF OF ENGINEERS, U. S. ARMY,
Washington, D. C.

Upper Machodoc Creek is a tributary of Potomac River, which it enters from the right shore about 64 miles below Washington, D. C. The creek is situated entirely in King George County, Va., and is at present navigable at mean tide by light-draft steamers to Milford Landing, about 7.7 miles above the mouth of the creek. The lower portion of the creek partakes of the character of a tidal estuary, the fluvial discharge being very small, and is used for a harbor of refuge for sailing vessels engaged in the oyster business in that vicinity.

Two steamers, drawing 5 to 6 feet of water, belonging to the Potomac and Chesapeake Steamboat Company, now enter the creek two and three times a week, respectively, on their way from Washington to river points below this creek, and on their return reenter the creek. These steamers ascend as far as Brick House wharf, stopping at intermediate wharves, tide permitting.

One steamer, drawing from 4 to 5 feet of water, belonging to the Potomac Navigation Company, now enters the creek three times a

week. This steamer plys between Washington and Milford Landing on this stream and touches at intermediate points on the creek and on the Potomac River.

URBANA CREEK, VIRGINIA.

Before the improvement of Urbana Creek, a tributary of the Rappahannock, a bar existed outside the mouth, over which but 6½ feet could be carried at low tide, and there was a shoal within the creek with a ruling depth of 7 feet.

The project for this improvement, adopted March 3, 1879, and modified in 1883, 1888, and 1897, provides for dredging a channel 150 feet wide and 10 feet deep through the outer and inner bars, with a turning basin of the same depth at the head, for a series of spur dikes at Bailey Point, and for a stone jetty to protect the cut through the outer bar. The final revised estimate of cost is $70,000.

The amount expended to June 30, 1909, was $43,319.78, of which $10,989.48 has been applied to maintenance since March 3, 1899. As a result of this expenditure there has been dredged a channel 10 feet deep and 150 feet wide through the outer bar, a channel 10 feet deep and 150 feet wide through the inner bar, and a turning basin 10 feet deep at the steamboat wharf. These channels have been redredged where shoaling had occurred.

Harbor lines have been established. Seven hundred and eighty-three linear feet of jetty has been constructed. The total amount of material dredged from the channel is about 144,300 cubic yards. There has been placed on the jetty about 1,095.4 cubic yards of stone.

The work during the fiscal year consisted in entering into a contract for the extension of the jetty, in a survey, in an inspection, and in miscellaneous office work, the incidental expenditure thereto being $180.37, which was applied to maintenance.

The maximum draft that could be carried on June 30, 1909, at mean low tide over the shoalest part of the locality under improvement was about 10 feet. The mean range of tide is 1.5 feet. The town of Urbana, at the mouth of the creek, is the head of navigation for steamers and large vessels, while small vessels ascend the stream for a distance of 3 or 4 miles.

The principal articles of commerce are lumber, oysters, cord wood, excelsior, coal, farm produce, canned goods, railroad ties, bricks, pickles, manufactured clothing, fertilizer, and general merchandise. The receipts and shipments during 1908 amounted to about 29,000 tons, and were estimated to be worth $991,503.

The work done has been of benefit to commerce, and it is understood that freight rates have been reduced.

Work on this improvement was suspended between 1903 and 1907 pending the result of legal proceedings instituted by the Government to secure the removal of part of a wharf which projected into the proposed channel and which had been built in violation of the provisions of the act of March 3, 1899.

The wharf was finally altered in accordance with the requirements of the War Department.

It is proposed to apply the additional appropriation recommended to the extension and maintenance of the jetty, the construction of a spur dike at Bailey Point, and the redredging of the outer bar.

The additional work proposed is partly for the extension of benefits and partly for the preservation of the work already done.

July 1, 1908, balance unexpended	$360.59
Amount allotted from appropriation by river and harbor act approved March 3, 1909	4,000.00
	4,360.59
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	180.37
July 1, 1909, balance unexpended	4,180.22
July 1, 1909, amount covered by uncompleted contracts	2,640.00
Amount (estimated) required for completion of existing project	33,489.48
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	17,000.00

YORK, MATTAPONI, AND PAMUNKEY RIVERS, AND OCCOQUAN CREEK, VIRGINIA.

(*a*) *York River.*—Prior to improvement 24 feet could be carried up York River for a distance of 32 miles, to Potopotank bar, over which the ruling depth was 18½ feet. West Point bar, the only other obstruction to navigation, had a least depth of 15½ feet.

The project for this improvement, adopted June 14, 1880, and revised in 1884 and 1887, provides for dredging channels 22 feet deep at mean low water and 400 feet wide through the bars, and for the construction of a dike along the right bank at West Point bar to maintain the channel, at a total estimated cost of $308,800.

The amount expended to June 30, 1909, was $258,685.04, of which $30,761.81 was applied to maintenance subsequent to March 3, 1899. This expenditure has resulted in a dredged channel 105 feet wide and 22 feet deep at Potopotank, and another 22 feet deep and 160 to 260 feet wide at West Point bar. A training dike 10,142 feet long has been constructed at West Point bar, of which 4,818 linear feet has been rebuilt and 3,474 linear feet has been repaired. The total amount of material dredged from the channels is about 1,160,100 cubic yards.

The entire project is now about 60 per cent completed.

The work of maintenance during the fiscal year consisted in rebuilding the dike, repairs to plant, and miscellaneous incidental work.

The maximum draft that could be carried on June 30, 1909, at mean low tide over the shoalest part of the locality under improvement was about 19 feet. The mean range of tides is about 3 feet. York River is navigable, throughout its entire length of 41 miles, to West Point at its head.

The principal articles of commerce are lumber, oysters, cord wood, tobacco, railroad ties, farm produce, ship timber, piles, and general merchandise. The receipts and shipments during 1908 amounted to about 178,445 tons, and were estimated to be worth about $7,222,846.

The work done has been of much importance to commerce, and it is understood that freight rates have been somewhat reduced.

It is proposed to apply the additional appropriation recommended to the repair of the dike and to redredging the channels.

The additional work proposed is for maintenance of work already done.

Amount (estimated) required for completion of existing project	$59,689.95

(*b*) *Mattaponi River.*—The Mattaponi River is navigable for small steamers and vessels from its mouth to Aylett, about 39 miles above, and navigable for small lighters and rafts from Aylett to Monday bridge, 16 miles farther. At the time of the adoption of the project the obstructions to 5½-foot navigation below Aylett consisted of 7 bars, upon which the ruling depths at low tide varied from 2.4 to 3.8 feet. Above Aylett there were numerous bars, but no work upon them has been proposed. The river was also obstructed by snags, wrecks, and overhanging trees.

The original project for improvement, adopted June 14, 1880, provided for the removal of snags, wrecks, and leaning trees below Monday bridge, and the improvement of the bars below Aylett, so as to give a depth of 5½ feet at low tide and a channel width of 40 feet, at an estimated cost of $34,059. This project was extended by the terms of the river and harbor act of July 13, 1892, which provided for the removal of snags as far up as Guineas bridge, near Milford station on the Richmond, Fredericksburg and Potomac Railroad. The estimated cost of this, which is the present project, is $72,100.

The amount expended to June 30, 1909, was $51,790.84, of which $18,022.34 has been applied to maintenance since March 3, 1899. This expenditure resulted in the removal of snags, logs, and overhanging trees from the river between the mouth and Monday bridge, and in keeping the river below Aylett free from such obstructions; in constructing 2,297 linear feet of dike at Robinson bar, and in dredging channels of the full projected dimensions through Line Tree, Latané, Robinson, Presque Isle, Sales, Walker, and Jones bars. The total amount of material dredged from the channels is about 69,613 cubic yards. The entire project is now about 35 per cent completed.

The work of maintenance during the fiscal year consisted of dredging, of snagging the river, and of engineering and miscellaneous incidental office expenses.

The maximum draft that could be carried at mean low water over the shoalest part of the channel June 30, 1909, was 3 feet at Walker bar. The mean range of tide is about 3.5 feet.

The principal articles of commerce are lumber, cord wood, farm produce, railroad ties, ship timber, piles, and general merchandise. The receipts and shipments during 1908 amounted to about 95,069 tons, and were estimated to be worth about $1,329,548.

The work done has been of considerable benefit to commerce, and it is understood that not only have shipments been facilitated, but that freight rates have been somewhat reduced.

It is proposed to apply the additional appropriation recommended to dredging, dike construction, and to snagging.

The additional work proposed is partly necessary to make the improvement available, partly for the extension of benefits, and partly for the preservation of work already done.

Amount (estimated) required for completion of existing project..... $30,841.03

(*c*) *Pamunkey River.*—At the time of the adoption of the project for the improvement of Pamunkey River a draft of 7 feet could be carried at low tide to Buckland bar, 38½ miles above its mouth. Between this bar and Bassett Ferry, a distance of 8½ miles, there were four bars, the ruling depths on which varied from 2½ to 5½ feet. Besides these bars the river was obstructed by wrecks, logs, snags, and overhanging trees.

The original, which is also the existing, project for the improvement of this river was adopted June 14, 1880, and amended in 1885 and 1908. It contemplates securing a channel 7 feet deep and 100 feet wide between Bassett Ferry and the mouth of the river, this result to be obtained by dredging and the construction of dikes, the latter being also designed to secure the dredged material deposited behind them. The wrecks, snags, logs, and trees obstructing navigation are also to be removed. The estimated cost of the revised project is $55,000. It is estimated that an expenditure of $5,000 is now required for maintenance, in addition to the work which can be done with available funds, and that in future the cost of maintenance will be $4,000 every four years.

The amount expended to June 30, 1909, was $34,263.57, of which $4,073.99 was applied to maintenance after March 3, 1899. This expenditure has resulted in dredging channels 100 feet wide and 7 feet deep through Buckland bar, 70 feet wide and 7 feet deep through Hogan bar, and 95 feet wide and 6 to 7 feet deep through Skidmore bar; in the construction of 1,478 linear feet of sheet pile dikes at Spring and Skidmore bars; in the construction of 14 permeable spur dikes, aggregating in length 2,332 linear feet, at Buckland and Hogan bars; in removing parts of eight wrecks, and in removing snags and similar obstructions from about 50 miles of river and keeping it free from such obstructions. The total amount of material dredged from the channels is about 24,485 cubic yards.

The entire project is now about 55 per cent completed.

The work of improvement done during the fiscal year consisted of dredging, and construction of permeable spur dikes, and the incidental expenses thereto were $5,754.97. The work of maintenance done during the fiscal year consisted of resnagging the lower 50 miles of river, and its incidental expenses were $1,201.94.

The maximum draft that could be carried on June 30, 1909, at mean low tide over the shoalest part of the locality under improvement was 5 feet. The mean range of tide is about 3½ feet. Bassett Ferry, 47 miles above the mouth of the river, is the head of navigation for vessels drawing 5 feet and navigation by small lighters and rafts extends about 15 miles above.

The principal articles of commerce are lumber, cord wood, railroad ties, ship timber, piles, and grain. The receipts and shipments during 1908 amounted to about 49,107 tons and were estimated to be worth about $559,516.

The work done has been of benefit to commerce, and it is understood that not only have shipments been facilitated, but freight rates have been reduced.

It is proposed to apply the additional appropriation recommended to dredging, snagging, and dike construction, as provided for by the approved project.

The additional work proposed is necessary to make the improvement available, and for maintenance and preservation of the work already done.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1887, 1888, and 1890.

For reference to the report on an examination and survey of Pamunkey River, see page 213 of the Annual Report of the Chief of Engineers for 1904.

Amount (estimated) required for completion of existing project..... $16,173.99

(*d*) *Occoquan Creek.*—In 1872 navigation in Occoquan Creek, a tributary of the Potomac River, was obstructed by three bars, over which but 1.2 feet could be carried at low tide. Aside from these obstructions the creek was amply wide and deep at low tide for vessels drawing up to 5 feet.

The original project for improvement, adopted March 3, 1873, and modified in 1879, provided for dredging channels 100 feet wide and 5 feet deep through the bars below the town of Occoquan, and the construction of a dike at Sand bar, at an estimated cost of $25,000. Four appropriations were made from 1873 to 1878, aggregating $25,000, and in 1880 the improvement was regarded as completed.

The existing project for this stream, adopted September 19, 1890, and extended by act of March 2, 1907, contemplates the dredging of channels 6 feet deep through the five bars obstructing 6-foot navigation below the town of Occoquan. These channels are to be 100 feet wide, except through the outer bar and the lower 2,000 feet of the bar next above it, where the channel is to be 150 feet wide. Dikes are to be constructed at the upper three bars. The estimaced cost of the project as modified is $64,000.

The amount expended under the existing project to June 30, 1909, was $50,797.97, of which $14,713.63 was applied to maintenance subsequent to March 3, 1899. As a result of this expenditure, channels of the full projected dimensions have been dredged through all of the bars and redredged where shoaling occurred, and 1,696 linear feet of dike has been constructed at Occoquan bar and Sand bar and repaired where injured by freshets and ice.

The total amount of material dredged from the channels is about 341,145 cubic yards. There has been placed in the dikes about 6,475 cubic yards of stone.

The entire project is now about 60 per cent completed.

The work of maintenance during the year consisted in an inspection and miscellaneous office work.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the locality under improvement was 6 feet. The mean range of tide is about 2 feet. The town of Occoquan, 6 miles above the mouth, is the head of navigation.

The principal articles of commerce are railroad ties, building sand, piles, cord wood, lumber, grain, farm produce, coal, and flour. The receipts and shipments during 1908 amounted to about 25,958 tons, and were estimated to be worth $101,931.

The work done has been of great benefit to navigation in this creek, and it is understood that not only have shipments been facilitated, but freight rates have been materially reduced.

It is proposed to apply the additional appropriation recommended to construction of dikes and maintaining the channels of the project.

The additional work proposed is for the purpose of extension of benefits and maintenance of the work already done.

Amount (estimated) required for completion of existing project..... $26,614.22

CONSOLIDATED.

July 1, 1908, balance unexpended.....	31,202.48
Amount allotted from appropriation by river and harbor act approved March 3, 1909.....	40,000.00
Amount received by allotment.....	5,981.31
	77,183.79

June 30, 1909, amount expended during fiscal year:		
For works of improvement	$11,385.54	
For maintenence of improvement	26,120.24	
		$37,505.78
July 1, 1909, balance unexpended		39,678.01
July 1, 1909, outstanding liabilities		2,319.78
July 1, 1909, balance available		37,358.23
July 1, 1909, amount covered by uncompleted contracts		7,138.69
Amount (estimated) required for completion of existing project		133,319.19
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		100,000.00

WATERWAY ON THE COAST OF VIRGINIA.

Following are extracts from a report on a recent survey contained in House Document No. 957, Sixtieth Congress, first session:

The Chief of Engineers, in submitting the report, says:

Cat River is a link in the chain of inland waterways on the Atlantic side of the eastern shore of Virginia. On the north it connects with Bogues Bay, in which the depths are less than in Cat River, so that any improvement of the river to be of value must be supplemented by a similar improvement of the bay. While Bogues Bay is not named in the act authorizing this examination, it would appear that an increase of depth through the bay is essentially an integral part of any proposed plan of improvement of the river.

The project proposed, therefore, is to dredge a channel 4 feet deep at mean low water throughout Cat River and across Bogues Bay, with bottom widths of 25 feet in the river and 50 feet in the bay, widening the channel where necessary at sharp bends. The cost of the work is estimated at $12,100, with $1,200 annually for maintenance after completion.

I concur in the opinion of the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors that the locality is worthy of improvement in the manner now proposed.

The commerce of the river is described in the report on the preliminary examination as follows:

Cat River is used mainly for the transportation of oysters from the bays south of Chincoteague to Chincoteague, from which point they are shipped to markets by rail via Franklin City. There is also a considerable traffic in other articles. Statistics collected in regard to the present annual commerce through Cat River are as follows:

500,000 bushels oysters	$500,000
12,000,000 clams	72,000
600,000 bushels shells	54,000
187,500 bushels sweet potatoes	150,000
75,000 bushels round (white) potatoes	116,250
3,000 cords wood	14,250
700 tons coal	5,600
1,000 tons hay	28,000
100,000 bushels grain and feed	75,000
Total	1,015,100

It was stated that with 100 licensed business places, the yearly business of Chincoteague, in addition to the above, is $2,000,000.

Craft engaged in the above business were given as follows:

400 small boats, not registered, valued at $300 each	$120,000
45 gasoline boats, valued at $850 each	38,250
107 boats between 5 and 20 tons, valued on an average of $500 each	53,500
22 vessels over 20 tons, averaging in value $3,000 each	66,000
1 steamer, valued at	3,500
150 barges and scows, averaging in value $250 each	37,500
Total	318,750

INLAND WATER ROUTE FROM NORFOLK, VA., TO ALBEMARLE SOUND, NORTH CAROLINA, THROUGH CURRITUCK SOUND.

This route extends from Norfolk, Va., to Albemarle Sound, via the Southern Branch of the Elizabeth River, Albemarle and Chesapeake Canal, North Landing River, Currituck Sound, Coanjock Bay, North Carolina Cut, and North River. The canal and cut mentioned are now controlled by a private corporation.

This route had originally a good 5-foot mean low-water channel, but navigation was obstructed by snags, sunken logs, and overhanging trees. Sharp bends added to the other difficulties of navigation.

Until the act of September 19, 1890, the work of improvement was carried on under several separate projects, upon which a total of $240,169.69 had been expended. By that act all these projects were consolidated.

The present project, adopted September 19, 1890, provides for obtaining a channel 80 feet wide and 9 feet deep at mean low water through the whole extent of the waterway to be improved by the United States, at an estimated cost of $360,667.08, including the previous expenditures above mentioned. The project is considered as complete, the additional work required being for maintenance. Since September 19, 1890, and up to June 30, 1909, the sum of $61,987.64 has been expended upon this improvement and $33,234.30 upon maintenance.

The expenditures during the fiscal year were applied to maintenance.

The work consisted in keeping the waterway clear of sunken obstructions.

The amount estimated as a profitable expenditure for the fiscal year ending June 30, 1911, will be applied in maintaining the improvement by keeping the various channels clear of logs, snags, and similar obstructions, and in redredging parts of the channel through Currituck Sound where these have deteriorated.

The channels through the various portions of the route are now from 60 to 80 feet wide and have a depth of 9 feet at mean low water. The draft of vessels which can pass through the route at mean low water on June 30, 1909, is 9 feet. The route is about 67 miles long.

There is no lunar tide in any portion of the route, except in the Southern Branch of the Elizabeth River, where the average rise and fall is 2.7 feet. In the other sections the water level varies according to the velocity and direction of the wind, for which an allowance of 0.5 foot is made, but severe storms may cause an elevation or depression of 2 feet or more.

The commerce has varied considerably since the route was opened to navigation. The highest reported was for the calendar year 1890, when it amounted to 403,111 tons. Since that time it has decreased considerably, and for the calendar year 1908 it amounted to 133,081 tons; value not known. The principal items of shipment consist of coal, fertilizer, and timber products.

The gradual decrease in the commerce of the route is due to the depletion of the forests and the consequent decrease in timber shipments.

It has not been found possible to ascertain what effect, if any, the improvement has had upon freight rates.

Considerable difficulty is experienced in keeping this waterway free from obstructions by logs dropped from rafts due to the improper construction of the rafts, and, in the absence of any adequate laws permitting the Engineer Department to control the construction of rafts, it has been found impossible to prevent the frequent occurrence of these obstructions.

July 1, 1908, balance unexpended	$1,827.16
Amount allotted from appropriation by river and harbor act approved March 3, 1909	1,500.00
	3,327.16
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,478.10
July 1, 1909, balance unexpended	1,849.06
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

WATERWAY FROM NORFOLK, VA., TO THE SOUNDS OF NORTH CAROLINA

This waterway extends from Norfolk, Va., via the Southern Branch of the Elizabeth River to Deep Creek, thence through the Dismal Swamp Canal to South Mills, N. C., and from the latter point through Turners Cut to the Pasquotank River, to Albemarle Sound, and thence to Pamlico Sound by Croatan Sound.

The draft which could be carried through this waterway at the time of the adoption of the project for improvement was limited to 2½ feet at mean low water, owing to the deterioration of the Dismal Swamp Canal, which originally had had a depth of about 6 feet.

The project, adopted March 3, 1899, provides for the dredging of channels in Deep Creek, Turners Cut, through a shoal in the Pasquotank River near Ship Yard bar, and through a bar in Croatan Sound near Croatan light. All these channels, except the last named, were to be 100 feet wide and 10 feet deep at mean low water. The Croatan channel was to be 200 feet wide and 12 feet deep at mean low water. For the protection of these channels sheet piling was to be driven where necessary. The estimated cost of this work was $274,310.

Up to June 30, 1909, the sum of $251,196.46 had been expended on the project and $9,090.91 on its maintenance. The project has been completed, and the additional work required is for maintenance.

The amount reported as expended during the fiscal year for maintenance was applied toward expenses of inspections of the water route made from time to time, dredging in Deep Creek, Virginia, and removing sunken obstructions in the Pasquotank River, North Carolina.

The amount estimated as a profitable expenditure for the fiscal year ending June 30, 1911, will be applied toward removal of obstructions and toward dredging for the purpose of maintaining the improvement.

On June 30, 1909, vessels drawing 10 feet of water can at mean low water navigate through all sections of the route which have been improved by the United States. The canal, which extends from Deep Creek to South Mills, is maintained at the expense of a private

corporation, which tries to keep it available for vessels of 10 feet draft, but on June 30, 1908, the limiting depth for the entire route was only 9 feet, owing to the existence of shoal places in the canal. Deep Creek is the only tidal portion of the improvement, and there the rise and fall averages 3 feet. In the other sections the water level changes according to the direction and velocity of the wind. The route is about 67 miles in length.

The commerce for the calendar year 1908 is reported to have amounted to 319,573 tons, valued at $5,613,700. The main items of commerce are coal, fertilizer, timber, and farm products.

It has not been found practicable to ascertain what effect, if any, the improvement has had upon freight rates.

July 1, 1908, balance unexpended	$4,820.40
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	2,237.77
July 1, 1909, balance unexpended	2,582.63
July 1, 1909, outstanding liabilities	1,107.22
July 1, 1909, balance available	1,475.41
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	5,000.00

HARBOR AT BEAUFORT, N. C.

When improvement (begun in 1836) was resumed in 1881, the erosion at Fort Macon and Shackelford points was causing serious deterioration of the inside channels and threatening deterioration of the bar channel. The governing low-water depth is said to have been 15 feet on the bar and 2 feet at Beaufort, N. C.

The original project is that of 1881, to stop erosion at the inlet (Fort Macon and Shackelford points) by jetties and to provide a channel 200 feet wide and 9 feet deep at ordinary low tide to Beaufort, and a channel 100 feet wide and 6 feet deep from Beaufort to the 6-foot contour of the channel leading up North River, estimated to cost $82,103.38, increased in 1885 to $159,000, when the project was modified by reducing the channel to Beaufort to 100 feet and its depth to 5 feet at mean low water and eliminating the channel east from Beaufort. In 1887 the estimate for the above work was further increased to $163,000.

The project was again modified in 1890, the project depth of the bulkhead channel being increased to 7 feet. The project as modified was completed.

The amount expended under the original project as modified was $148,843. To the above amount should be added $5,000, appropriated July 4, 1836, making the total cost up to the completion of the original project $153,843.

The existing project of 1896 includes the maintenance of jetties and sand fences at Fort Macon and Shackelford points and the maintenance of the 7-foot channel across Bulkhead shoal and thence to the wharves at Beaufort. The object of the jetties and sand fences is to protect the land on the opposite sides of the inlet, thus preventing the inlet from shifting and deteriorating.

The jetties have been successful in preventing the inlet from widening and shifting, but deterioration of the depths obtained in the

main channel is quite rapid, due to the fact that the inlet is still too wide to enable its tidal discharge to keep the channel scoured out to the proper depth.

The river and harbor act of March 2, 1907, authorized a sufficient amount of the appropriation made therein to be applied to repairing existing jetties at Fort Macon Point and constructing additional jetties and shore protection.

The amount expended on present project for maintenance to June 30, 1909, was $30,601.99.

The expenditures of the year were for building and maintaining sand fences at Fort Macon and Shackelford points and for restoring the dredged channels in front of Beaufort and across Bulkhead shoal to 100 feet width and 7 feet depth at mean low water.

A draft of 7 feet at mean low water can now be carried to the wharves at Beaufort.

It is proposed to expend the available balance and the appropriation recommended in maintaining the dredged channels, building and maintaining sand fences at Fort Macon and Shackelford points, and possibly in repairing and building rock jetties at these points should erosion increase.

The tide rises 2 feet at Beaufort and 3 feet at the inlet.

The commerce for the year 1908 amounted to 46,178 tons, valued at approximately $2,137,369.

The maintenance of this channel tends to prevent the rise in freight rates by allowing the larger vessels to reach the wharves at Beaufort.

References: Annual Reports, 1881, page 1013; 1893, page 1457; 1896, page 1115; 1899, page 1498, House Document No. 1454, Sixtieth Congress, second session.

July 1, 1908, balance unexpended	$14,057.47	
Amount received as rent during fiscal year	375.00	
		14,432.47
June 30, 1909, amount expended during fiscal year, for maintenance of improvement		10,152.46
July 1, 1909, balance unexpended		4,280.01
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		5,000.00

BEAUFORT INLET, NORTH CAROLINA.

When improvement began in September, 1905, there was a minimum depth on the bar of approximately 12 feet at mean low water.

The original project, which is also the existing project, is printed on page 1415 of the Annual Report of the Chief of Engineers for 1904 and was adopted by Congress in 1905. It contemplates a channel 300 feet wide, 20 feet deep at mean low water, across the bar, to be obtained by dredging, at an estimated cost of $45,000.

Amount expended on existing project to June 30, 1909:		
For improvement	$44,484.24	
For maintenance	439.36	
Total		44,923.60

The work to date has consisted of the necessary surveys, etc., and the dredging of 426,630 cubic yards of material from the bar channel

in 1906 and 1907. The result of this work was an increase of the minimum depth on the bar from 10.8 feet at mean low water when work began to about 20 feet on June 30, 1907, the minimum width of the 20-foot channel being about 200 feet. This channel has deteriorated during the past two years, the minimum mean low-water depth on June 30, 1909, being only 13 feet. The tide rises 3 feet at the inlet.

About 65 per cent of the project is completed.

There was no work done during the fiscal year.

It is proposed to expend the available balance and the appropriation recommended in restoring the dredged channel to the project depth, and obtaining the project width.

The commerce for the year 1908 amounted to 20,575 tons, valued at $700,625, and consisted principally of fish, lumber, cross-ties, and general merchandise.

Compared with the commerce for 1907, this shows a gain of 4,706 tons, or nearly 33 per cent.

The effect of this improvement will be to lessen freight rates by affording water transportation for products which have hitherto been dependent entirely upon railroads.

This work is designed to provide a deep-water outlet to the ocean for the inland waterway, Pamlico Sound to Beaufort Inlet, North Carolina.

July 1, 1908, balance unexpended	$5,203.07
Amount allotted from appropriation by river and harbor act approved March 3, 1909	15,000.00
	20,203.07
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	126.67
July 1, 1909, balance unexpended	20,076.40
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	15,000.00

SHALLOWBAG BAY, NORTH CAROLINA.

The following report of the Board of Engineers is concurred in by the Chief of Engineers and printed in House Document No. 906, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., April 20, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

The district officer submits estimates of cost of dredging channels 100 feet wide and 6, 7, and 8 feet deep in Shallowbag Bay, amounting to $13,750, $33,000, and $51,480, respectively. He invites attention to the fact that there is practically no lunar tide at this point and that variations of water level, which seldom exceed 1 or 2 feet higher or lower than mean low water, are due to the influence of the wind. As his estimates provide for 1 foot over depth of excavation, it will be seen that the 6-foot project proposed by him will afford 7 feet or more in favorable weather and 6 feet at all times.

In order to have before it all available information affecting the advisability of providing an 8-foot channel, as specified in the act, the Board, when considering the report on the preliminary examination, invited interested parties to submit statements and arguments setting forth their views in regard to this matter. From the information presented it was evident to the Board that the locality was worthy of some consideration at the hands of the General Government, though it was equally evident that only a moderate expenditure would be warranted. The Board is of the opinion that the

cost of providing a greater depth than 6 feet is not at present justified by the commerce of the locality, but in view of the fact that this commerce, though not of great amount, is entirely dependent upon water transportation, it concurs with the district officer and the division engineer in believing that the locality is worthy of improvement to the extent of providing a channel 6 feet deep at mean low water in the manner proposed in the within report, at a total cost of $13,750 and an annual outlay of $2,000 for maintenance after completion.

With reference to increasing the width of the channel to 150 feet, as suggested by the division engineer, the Board believes that the channel as proposed by the district officer will meet the present requirements of the situation, and that the question of its enlargement can properly be left for future consideration, particularly as the additional expenditure involved does not at this time appear to be justified by the commercial interests of this locality.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

The commerce for the year 1907 amounted to 6,091 tons, valued at $395,680. Nine thousand passengers were transported.

BAY RIVER, NORTH CAROLINA.

Report on a recent survey is printed in House Document No. 583, Sixty-first Congress, second session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., January 11, 1910.

Respectfully returned to the Chief of Engineers, U. S. Army.

The district officer estimates that a suitable channel 10 feet in depth and 150 feet in width to a point 3,500 feet below Stonewall and 10 feet in depth and 100 feet in width thence to Bayboro can be secured for $21,000 and maintained at an annual cost of $1,000. He believes the improvement advisable to this extent, and in this view the division engineer concurs.

It is stated that the commerce to be affected by this improvement amounts to about 70,000 tons annually, valued at about one and three-quarter million dollars, which, in the opinion of the Board, is sufficient to justify the expenditure proposed by the district officer.

In view of the above, the Board concurs with the district officer and the division engineer in the opinion that it is advisable for the General Government to undertake the improvement as outlined within.

It appears from the report of the district officer that while there are no public wharves on the stream, the privileges of using the private wharves are extended to all on equal terms.

In compliance with the provisions of section 13 of the act of March 3, 1909, the Board further reports that neither the establishment of terminal facilities, the development and utilization of water power for industrial and commercial purposes, nor any other subjects not considered within are so related to the project for improvement of navigation at this locality as to be coordinated in a logical and proper manner with such project to lessen the cost thereof and to compensate the Government for expenditures made in the interest of navigation.

For the Board:

WM. T. ROSSELL,
Colonel, Corps of Engineers,
Senior Member of the Board.

CAPE FEAR RIVER ABOVE WILMINGTON, N. C.

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 890, Sixtieth Congress, first session.

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., April 13, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

This is a report on a reexamination of Cape Fear River above Wilmington, "with a view to reporting what modifications, if any, should be made in the existing project."

The existing project, adopted by the act of June 13, 1902, provides for a low-water depth of 8 feet to Fayetteville, by means of three locks and dams, at an estimated cost of $1,350,000. An appropriation of $50,000 was made by the same act for survey expenses and the purchase of lock and dam sites. One site has been purchased, and condemnation proceedings are being conducted with reference to obtaining lands at the other two sites.

As the original examination resulting in the present project covered depths of 4, 6, and 8 feet, the district officer now discusses a revision of the project with a view to providing similar depths. Plan A provides for one lock and dam to be located about 30 miles below Fayetteville, with regulation work below, the cost being $460,000 and the annual cost of maintenance $15,000. As noted in the detailed estimate given, this plan requires considerable jetty or levee work, the result of which can not be definitely determined. It may or may not result in the 4-foot depth hoped for. Plan B is also for a depth of 4 feet but involves two locks and dams, the estimated cost being $550,000 and $8,000 annually for maintenance. This plan carries a full slack-water depth of 4 feet down to a point below which an equal depth now exists. With reference to a 6-foot depth, the district officer states that this would require two locks and dams, the location of which would be nearly identical with the sites for locks and dams under an 8-foot project, and as the cost would be very little more than a 4-foot project and very little less than an 8-foot project, this depth is not practical, and is therefore not further considered. The plan for an 8-foot depth provides for two locks and dams at a total cost of $615,000, with $8,000 annually for maintenance.

As the first-mentioned plan for a 4-foot depth, involving one lock, is not certain of accomplishing a continuous 4-foot navigation, and as this plan costs but little less than the one involving two locks and dams, which is reasonably certain of success, the selection of a plan appears to lie between the 4-foot navigation, involving two locks and dams, and the 8-foot navigation, involving a like number of locks and dams. The district officer states that "It seems that the present and reasonably prospective commerce of this river will be amply provided for for many years to come by a depth of 4 feet," and the division engineer says, "I do not believe that an 8-foot navigation to Fayetteville is necessary at this time. A navigation of 4 or 5 feet, in my judgment, would be quite sufficient." For these reasons they unite in recommending the 4-foot depth, at an estimated cost of $550,000.

Inasmuch as Congress has already authorized the improvement of the river to the extent of beginning operation on a project, the cost of which is more than double that now proposed, the Board feels that the advisability of undertaking the work has already been definitely determined, and submits no new recommendation on this point. It concurs in the general opinion that at the present time, and probably for a number of years to come, a permanent 4-foot navigation would meet the demands of commerce on this section of the river. Attention is invited to the fact, however, that the difference between the cost of the 4-foot and the 8-foot project is but $65,000, that the total cost of such a project is now less than half the cost of the plan adopted by Congress, that the time may come when a greater depth than 4 feet will be necessary and advisable, and that the cost of changing a 4-foot established improvement to an 8-foot depth would almost equal the original cost of the project and be very undesirable. For these reasons the Board believes that it will be good business judgment and in the interests of economy to provide for the 8-foot navigation at the present time.

In view of these facts the Board recommends that the project for the Cape Fear River above Wilmington be modified to provide for an 8-foot depth, by means of two locks and dams, at an estimated cost of $615,000 in accordance with the plans outlined within.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

The total commerce for 1906 amounted to 135,991 tons, valued at $3,630,078.

CAPE FEAR RIVER, NORTH CAROLINA, AT AND BELOW WILMINGTON.

The condition of the river prior to the opening of New Inlet (which seems to have occurred during an equinoctial storm in 1761) is rather uncertain, but old maps indicate that there was a low-water depth of 14 feet across the bar at the mouth, the least depth between

Wilmington and the mouth being 7.5 feet. There is also some uncertainty as to the conditions in 1829, when the improvement was first undertaken by the United States, but the most reliable information is that there was then about 7 to 7.5 feet at low water in the river, about 9 feet in Baldhead channel, 9 feet in the Rip channel, and 10 feet at New Inlet. Work on the bar was first begun in 1853, at which time the bar depths at low water were 7.5 feet in Baldhead channel, 7 feet in Rip channel, and 8 feet at New Inlet, the governing low-water depths in the river having been increased to 9 feet.

The original project of 1827 was to deepen by jetties the channel through the shoals in the 8 miles next below Wilmington. This project resulted in a gain of 2 feet available depth. The project of 1853 was to straighten and deepen the bar channel by dredging, jettying, diverting flow from the New Inlet, and closing breaches in Zekes Island. This project was incomplete when the civil war began.

After the civil war the first project was that of 1870, to deepen the bar channel by closing breaches between Smiths and Zekes islands, with the ultimate closure of New Inlet in view. The project of 1873 included that of 1870, and in addition the dredging of the bar channel and closing of New Inlet. The project of 1874 was to obtain by dredging a channel 100 feet wide and 12 feet deep at low water up to Wilmington. The project of 1881 was to obtain by dredging a channel 270 feet wide and 16 feet deep at low water up to Wilmington. These projects had been practically completed in 1889.

The project adopted September 19, 1890 (see Annual Report of the Chief of Engineers for 1889, p. 1132), is to obtain a mean low-water depth of 20 feet and a width of 270 feet from Wilmington to the ocean, at an estimated cost of $1,800,000. This project was modified by act of June 13, 1902, to authorize the construction of mooring dolphins at Wilmington at a cost of $30,000, and to provide for the removal of obstructions at mouth of Brunswick River, at an estimated cost of $1,000. The project was modified by the river and harbor act of March 2, 1907, which provides for continuing improvement in accordance with report submitted in House Document No. 545, Fifty-ninth Congress, first session, for completion of the 20-foot project to the projected width, by dredging and the excavation of a mooring basin in lieu of constructing mooring dolphins at Wilmington, involving a reduction in the estimate of cost to $1,392,750, including removal of obstructions at mouth of Brunswick River. The act also authorized improvement to such depth in excess of 20 feet as appropriations for the work may permit, due regard being given to the difference in tidal oscillation at the upper and lower portions of the improvement, and authorizes so much as may be necessary of the funds available to be applied to repairing the New Inlet and Swash Defense dams. The cost of these repairs is estimated at $165,000. Annual maintenance is estimated to cost $65,000.

The river and harbor act of March 2, 1907, appropriated the sum of $165,000 for improvement and authorized an additional expenditure of $250,000, all of which has since been appropriated, and the river and harbor act of March 3, 1909, provided an additional appropriation of $300,000 for this improvement.

No contracts for improvement have yet been made.

EXPENDITURES.

Prior to civil war (including balance transferred)		$363,228.92
Since civil war on prior projects		2,102,271.93
On existing project to June 30, 1909:		
For improvement	$1,430,798.54	
For maintenance	447,729.45	
		1,878,527.99
Total		4,344,028.84

On September 17, 1906, a storm of extreme violence very materially injured Swash Defense and New Inlet dams throughout their entire length and wholly destroyed Swash Defense dam in several places.

The total results obtained on the project up to the end of the fiscal year may be summarized as follows:

From the ocean to the lower end of Reaves Point Shoal there is a 22-foot mean low-water channel with a least width of 150 feet. At Reaves Point the channel is 20 feet deep and 270 feet wide, and from Reaves Point to Wilmington there is a channel 22 to 24 feet deep of varying widths. The repairs to Swash Defense dams are about 60 per cent completed.

The average rise of the tides is 4½ feet at the ocean bar, 3½ feet at Keg Island, and 2½ feet at Wilmington.

The distance from the ocean bar to Wilmington is 30 miles, and the river is navigable 115 miles farther up to Fayetteville, the head of navigation.

The additional work proposed with funds on hand and the additional sum requested is toward the prosecution of the project and maintenance during the progress of the improvement.

The commerce of the year 1908 amounted to 864,071 tons, valued at $49,753,175.

The commerce consisted principally of cotton, cotton-seed meal, naval stores, manufactured lumber, shingles, fertilizers, fertilizer material, coal, gum logs, cross-ties, and general merchandise.

As a result of the improvement, vessels coming to Wilmington are much larger than formerly, the average tonnage in 1886 being 421, while in 1908 the average was 1,345. This increase in tonnage has caused a corresponding decrease in freight rates on shipments by water.

July 1, 1908, balance unexpended		$280,071.30
Amount allotted from appropriation by river and harbor act approved March 3, 1909		300,000.00
Amount appropriated by sundry civil act approved March 4, 1909		100,000.00
Amount received from sales during fiscal year		250.37
		680,321.67
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$202,865.56	
For maintenance of improvement	60,000.00	
		[a] 262,865.56
July 1, 1909, balance unexpended		417,456.11
July 1, 1909, outstanding liabilities		17,076.36
July 1, 1909, balance available		[b] 400,379.75
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		500,000.00

[a] Exclusive of $1,000 expended in work at Fort Caswell for the Quartermaster's Department, for which this appropriation is to receive reimbursement.

[b] Includes the $1,000 reimbursement due from the Quartermaster's Department

CONTENTNIA CREEK, NORTH CAROLINA.

Distance from the mouth to Snow Hill, 31½ miles; Speights bridge, 50½ miles; Stantonsburg, 63 miles.

Previous to improvement this stream was obstructed throughout its entire length by fallen timber, sand shoals, and overhanging growth, and was navigable for shallow-draft craft during only the higher freshet stages of about three to six months of the year.

The original project of 1881 was to clear the stream of these obstructions, so as to obtain from its mouth to Stantonsburg, 63 miles, a depth of not less than 3 feet during the higher stages, about nine months of the year, at a cost estimated in 1888 at $77,500.

The project of 1881 as extended in 1894 included maintenance below Snow Hill, and was again extended in 1899 to include maintenance from Stantonsburg to the mouth. The project has been completed, and additional work required is for maintenance.

Amount expended up to June 30, 1909:	
For improvement	$64,394.56
For maintenance	10,096.33
Total	74,490.89

The work of the year consisted of maintenance by snagging between the mouth of the creek and the twenty-fourth mile post and between the thirty-fifth and forty-second mile post.

At the close of the fiscal year the creek between its mouth and Snow Hill was in fair condition and could be navigated during six months of the year by boats drawing 3 to 4 feet, depending upon the rainfall. Snow Hill, 31½ miles from its mouth, is practically the head of navigation, although during the higher stages of water boats can ascend the stream to Speights bridge, 50½ miles from its mouth.

The portion of the stream between Snow Hill and Fools Bridge, 10½ miles above, is now being resnagged, the upper 7 miles having been completed, and the remaining 3½ miles will be completed with funds now in hand.

The stream is subject to freshets rising 15 feet above low water at Snow Hill and Stantonsburg.

The commerce for the year 1908 amounted to 18,800 tons, valued at approximately $516,712. It consisted principally of cotton, cotton-seed meal, timber, lumber, fertilizer, general merchandise, etc.

The effect of the improvement on railroad and boat rates can not be definitely stated, but the stream when opened to navigation affords an outlet to farm products, timber, lumber, etc., which have no other outlet except by wagon.

It is proposed to apply the available balance and the appropriation recommended to maintenance below Speights bridge.

July 1, 1908, balance unexpended		$1,713.46
Amount received as rent during fiscal year		125.00
		1,838.46
June 30, 1909, amount expended during fiscal year, for maintenance of improvement		1,027.35
July 1, 1909, balance unexpended		811.11
July 1, 1909, outstanding liabilities		361.91
July 1, 1909, balance available		449.20
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		2,000.00

FISHING CREEK, NORTH CAROLINA.

When improvement began the stream was badly obstructed by masses of fallen timber, overhanging trees on banks, logs and snags in channel, and was navigable by rafts only a few miles above the mouth.

The original project of 1889 was to clear the stream of logs, snags, trees, etc., up to Bellamy's mill. It was amended in 1896 to limit the work to that part below the Wilmington and Weldon Railroad bridge, and this amended project was completed in 1901. The sum of $22,715.10 was spent on this project, which has been finished.

Amount expended on present project up to June 30, 1909, for maintenance, $2,534.90.

The lower 6 miles of the stream was cleared of obstructions in 1909.

It is not navigable above Beech Swamp on account of its tortuous course and rapid current. Below that point it is navigable during the higher stages about eight months annually.

The stream is reported by those interested in its navigation to be in poor condition to Beech Swamp, being badly obstructed by fallen trees, logs, and snags. Between Beech Swamp and the railroad bridge the condition of the stream is unknown, but it is presumably bad. The owners of the vessels navigating this stream report that there are so many obstructions that it is unsafe to navigate unless the water is at least 2 feet higher than the stages at which it was safe to navigate just after the stream had been cleared out.

The present head of navigation is Beech Swamp, 17.5 miles from its mouth, to which about 2 feet can be carried during about three months of the year.

The water surface varies from a minimum depth of 6 inches at low water to 10 feet during the high freshet stages.

The commerce for 1908 amounted to 1,694 tons, valued at $29,851, showing a gain over that for 1907 of 203 tons. It consisted principally of cotton seed, cotton-seed meal, fertilizers, timber, etc.

The effect of the improvement on railroad and boat rates can not be definitely stated; but the stream when opened to navigation affords an outlet to farm products, timber, lumber, etc., which have no other outlet except by wagons.

It is proposed to apply the appropriation recommended to the maintenance of the natural channel as far as Beech Swamp.

July 1, 1908, balance unexpended	$347.12
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	347.12
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement	1,500.00

NEUSE AND TRENT RIVERS, NORTH CAROLINA.

(*a*) *Neuse River.*—Distance from Newbern to Contentnia Creek, 32 miles; to Kinston, 50 miles; to Whitehall, 74 miles; to Goldsboro (Wilmington and Weldon Railroad bridge), 94 miles; to Smithfield, 150 miles.

There is considerable uncertainty as to the conditions existing prior to 1878, when improvement by the Government was begun. Before the civil war, and probably for some time afterwards, light-draft steamers made more or less regular trips as high up as Smithfield, but

the low-water depth probably did not exceed 2 feet, and the stream was obstructed by snags and after the civil war by war blockades. (See Annual Report of the Chief of Engineers for 1905, p. 240.)

The original project of 1871, as extended in 1878–79 and 1880 and continued to date, provides for an 8-foot navigation up to Newbern during the entire year, 4 feet to Kinston, and during nine months of the year 3 feet to Smithfield, by the removal of war obstructions, dredging, jettying, and snagging, at a total estimated cost of $374,000; extended in 1902 to include dredging a channel 300 feet wide below Newbern and 200 feet wide at Newbern, to a depth of 8 feet at dead low water, in accordance with report and estimate printed in Annual Report of the Chief of Engineers for 1905, page 1427, at an estimated additional cost of $59,081.25. Since its adoption this additional estimate has been reduced to $24,000.

In 1902 the improvement of this river was combined with that of the Trent.

Amount expended on foregoing projects to June 30, 1909:

For improvement	$331,144.77
For maintenance	23,107.69
Total	354,252.46

The expenditures for the year were $8,106.94, of which $3,721.10 was for maintenance, which consisted of snagging between Newbern and Seven Springs, and $4,385.84 was for improvement, which consisted of dredging at Union Point shoal and at a shoal in the western channel about 2 miles above Newbern.

As a result of the expenditures to date the channel at and below Newbern has been completed to project width and depth, all war blockades having been cleared away, and the natural channel has been cleared to Smithfield, 150 miles above Newbern. No attempt has been made to maintain the stream above Waynesboro Landing (Goldsboro), 98¼ miles above Newbern. At low water 8 feet can be carried to Newbern, 4 feet to Village Creek, 25 miles above, 2.5 feet to the mouth of Contentnia Creek, 31½ miles above Newbern, and 1 foot to Kinston, 50 miles above Newbern, above which point the river is not navigable on stages of less than 2 to 3 feet.

A channel known as the "Western channel," immediately above Newbern, has been cleared to a depth of 4 feet at mean low water, and is now being dredged to a depth of 4 feet at dead low water.

The channel of the river between Newbern and Seven Springs, near Whitehall, is in good condition.

The practical head of navigation is Waynesboro Landing, about 136 miles from the mouth of the river.

The stream is nontidal. The variation of the water surface below Newbern is due entirely to the influences of the wind. The maximum range is 3.3 feet during severe northwest winds to 8½ feet during violent northeast gales. The upper river is subject to freshets, which rise 17 feet at Smithfield, 18 feet at Waynesboro Landing, and 20 feet at Kinston.

The funds on hand are to be used for maintenance and in securing the project depth of 4 feet between Newbern and Kinston by dredging.

It is not considered practicable to carry out the project above Newbern as it now stands for any reasonable amount of money, but the appropriation recommended will be applied toward securing 4 feet

to the mouth of Contentnia Creek and 2 feet thence to Kinston by jetties, training walls, and dredging where necessary, and toward maintenance of the improvement.

The commerce of the year amounted to 384,418 tons, valued at $7,083,720. It consisted of grain, timber, lumber, fertilizers, general merchandise, etc. One of the causes of the falling off of the commerce is the discontinuance of the line of steamers between Newbern and Belhaven.

Freight rates are materially lessened by reason of the improvement.

(*b*) *Trent River.*—Distance from the mouth at Newbern to Polloksville, 18 miles; to lower Quaker bridge, 27 miles; to Trenton, 38 miles. Its original condition was a channel of 6 feet depth to Polloksville, and the stream was fairly clear to lower Quaker bridge, above which point it was badly obstructed.

The original project of 1879 (see Annual Report of the Chief of Engineers for 1879, p. 711) was to secure 3 feet depth at low water to Trenton; extended in 1886 to obtain 8 feet depth through Foys flats; extended in 1889 to clear out obstructions to upper Quaker bridge, 40 miles above Trenton. The sum of $64,262.64 was expended on this project and its modifications.

In 1896 the project of 1879 was amended to provide for the maintenance of a channel only 30 feet wide and 3 feet deep from Newbern to Trenton, at an annual estimated cost of $2,500. This was extended in 1902 to include dredging at Newbern to 8 feet depth at dead low water from harbor line to channel, at an estimated cost of $24,000 additional. The existing project, therefore, is to dredge to 8 feet dead low water at Newbern and maintain a channel 30 feet wide and 3 feet deep at low water to Trenton. In 1902 the improvement of this river was combined with that of the Neuse. This project has been completed.

By joint resolution approved March 4, 1907, authority was given to expend such portion of the appropriation made in river and harbor act of March 2, 1907, as may be necessary for securing a channel 6 feet deep over Foys flats in the Trent River, about 4 miles above Newbern. This work has been done.

Amount expended on existing project up to June 30, 1909:	
For improvement	$25,817.78
For maintenance	18,378.61
Total	44,196.39

The expenditures for the year were $5,205.64, of which $2,079.17 was for improvement and $3,126.47 for maintenance.

The work of the year resulted in obtaining a depth of 6 feet at dead low water over Foys flats, as outlined in joint resolution approved March 4, 1907, and in maintaining the channel between Newbern and Trenton. The project is completed, except for maintenance.

The improvement above Trenton has been abandoned.

Between Trenton and Newbern a 4-foot channel exists and the stream is in good condition. The maximum draft that can be carried June 30, 1909, to Trenton, 38 miles above the mouth, which is the head of navigation, is 4 feet.

Near the mouth the water level varies about 3 feet under normal conditions, according to the prevailing winds. Long protracted easterly or westerly winds sometimes cause a variation of 7 or 8 feet.

At Trenton the stream is subject to freshets of about 5 to 15 feet during the winter months.

The commerce for the year 1908 amounted to 237,240 tons, valued at approximately $4,847,611, showing a decrease, compared with 1907, of 31,136 tons, valued at $7,217,867. This falling off in volume of commerce is directly attributable to the abandonment of a line of steamers formerly operated by the Norfolk and Southern Railway Company between Belhaven and Elizabeth City, after this company had built a railroad connecting these points.

The commerce carried consisted principally of fertilizers, general merchandise, machinery, timber, lumber, etc.

The effect of this improvement on freight rates is not known, but it affords transportation facilities to the town of Trenton, which has no other means except by wagon.

The available balance and the appropriation asked for will be applied to maintenance of the improvement.

CONSOLIDATED.

July 1, 1908, balance unexpended		$20,327.09
Amount received as rent during fiscal year		625.00
		20,952.09
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$6,465.01	
For maintenance of improvement	6,847.57	
		13,312.58
July 1, 1909, balance unexpended		7,639.51
July 1, 1909, outstanding liabilities		2,488.02
July 1, 1909, balance available		5,151.49
Amount (estimated) required for completion of existing project		72,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		33,000.00

Report on a recent survey of Trent River is printed in House Document No. 1471, Sixtieth Congress, second session.

The report of the Board of Engineers, in which the Chief of Engineers concurs, is as follows:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., January 18, 1909.

Respectfully returned to the Chief of Engineers, U. S. Army.

When recommending the survey of Trent River between Newbern and Trenton, the Board was in doubt as to the advisability of improving the river to the full extent of the depth specified in the act, namely, 8 feet, but believed that an improvement to a depth of 4 or 6 feet might be found advisable, and it recommended that estimates for all three depths be submitted.

In his report on the survey the district officer estimates the cost of securing an 8-foot channel by dredging at $148,000, with an annual charge for maintenance of $10,000, and by means of a lock and dam at $100,000, with $3,000 annually for maintenance. The estimate for a 6-foot channel to be obtained by dredging is $64,000, and $6,000 annually for maintenance, and for a 4-foot channel $13,300, and $2,000 annually for maintenance. For reasons clearly stated, the district officer recommends the improvement to a depth of 4 feet, and in this recommendation the division engineer concurs. He believes, however, that the estimate of the district officer should be slightly increased to cover the removal of stumps and bank snags, and places the cost of the total work deemed advisable for a 4-foot depth at $15,000.

On January 11, 1909, Hon. F. M. Simmons, U. S. Senator, Hon. C. R. Thomas, M. C., and Hon. John H. Small, M. C., appeared before the Board with reference to this subject, and again on January 18 Senator Simmons presented his views.

With the completion of the work now authorized there will be a navigable depth of 8 feet from Newbern to a point about 3 miles above Polloksville, a distance of 21 miles. The 6-foot depth extends to a point 27½ miles above Newbern. This leaves a distance of about 10½ miles to Trenton with a less depth than 6 feet.

Having considered the advantages and relative cost of the several channels estimated upon and their probable benefit to commerce, the Board has arrived at the conclusion, concurring with the district officer and the division engineer, that Trent River is not worthy of improvement to the extent of providing a channel 8 feet in depth, but that it is worthy of improvement to a depth of 4 feet, at a first cost, as recommended by the division engineer, of $15,000, and $2,000 annually for maintenance.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

The country through which the river flows is said to be one of the richest in the State. It is also quite thickly settled. The population of Jones County is about 8,000, and its area is 450 square miles. The land is level and quite rich. Cotton is the principal crop, 5,000 to 6,000 bales being produced annually. Nearly 75,000 tons of lumber are shipped from the county annually, and lumbermen state that there will be almost no diminution in the amount for the next ten years.

The growth of commerce on this stream has been very great. The following table shows its increase since improvement was begun on the river:

Year.	Tons.	Value.	Year.	Tons.	Value.
1878	22,000	Not given.	1898	161,687	Not given.
1880	89,985	Do.	1899	137,017	Do.
1891	45,080	Do.	1900	130,162	$5,206,480
1892	59,576	Do.	1901	166,987	6,679,480
1893	34,649	Do.	1902	201,704	8,068,160
1894	28,055	Do.	1903	251,055	10,042,200
1895	142,422	Do.	1904	284,935	11,397,400
1896	142,100	Do.	1905	262,135	10,485,400
1897	142,788	Do.	1906	343,507	15,456,539

NEW RIVER, NORTH CAROLINA, INCLUDING INLAND WATERWAYS BETWEEN BEAUFORT HARBOR AND NEW RIVER AND BETWEEN NEW RIVER AND SWANSBORO.

The act of March 2, 1907, combined these three improvements under this new heading.

(*a*) *New River.*—Appropriations amounting to $50,000 were made for the river in 1836, 1837, and 1838, after which no further appropriations were made until 1882, when $5,000 was appropriated. Another appropriation of $5,000 was made in 1884; but since these amounts were considered too small to justify undertaking the improvements, no work was done until 1886, when still another appropriation, of $10,000, was made.

When improvement began in 1886, the governing low-water depth was 4 feet for a distance of 23 miles to Jacksonville, and the channel included two circuitous parts around Wrights Island and Cedar Bush Marsh.

The original project of 1886 was to dredge a cut 4 feet deep and 100 feet wide through Wrights Island and a second cut 4 feet deep and 150 feet wide through Cedar Bush Marsh. Both were completed, but the Cedar Bush Marsh cut deteriorated at the upper end

and was abandoned, and the project of June 18, 1894, to obtain 4 feet depth around Cedar Bush Marsh by dredging and an experimental timber training wall was adopted and successfully carried out. The additional work required is for maintenance.

The act of March 3, 1905, authorized the balance from the project of 1894 to be expended in rebuilding the dike hitherto constructed. This was done, and the dike is now permanent.

Amount expended since civil war on previous projects	$20,442.35
Amount expended on present project of 1894 (as amended to date) up to June 30, 1909:	
For improvement	9,186.39
For maintenance (including rebuilding dike)	3,413.40
Total	33,042.14

The expenditures during the year were for office expenses.

It is proposed to apply the existing balance and the appropriation recommended to maintenance.

The project depth of 4 feet has twice been obtained and twice lost through lack of maintenance. The project depth now exists, although the channel is quite narrow near the head of the marshes. The tidal range at the inlet is about 3½ feet and at the head of the marshes about 1 foot. The head of navigation for all practical purposes is Tar Landing, 3 miles above Jacksonville and 26 miles from the mouth of the river, to which a present depth of 4 feet can be carried. The depth on the bar at the mouth of the river is now 4 feet, but varies from time to time.

The commerce for 1908 amounted to 4,487 tons, valued at $189,360. It consisted principally of timber, fish, cotton, cotton seed, and general merchandise. The decrease from last year is due principally to the shutting down temporarily of the sawmills at and near Jacksonville.

In its present condition this stream probably has very little effect on freight rates in general, but it affords transportation for products which would otherwise have no means of transportation except by wagon. If the bar and channel were sufficiently improved to justify a line of steam vessels between Wilmington and Jacksonville, freight could probably be carried to the latter point much more cheaply than at present.

(*b*) *Waterway between New River and Swansboro, N. C.*—This waterway is a part of the waterway between Beaufort Harbor and New River (see pp. 1124–1127, Annual Report of the Chief of Engineers for 1889), but in 1890 two separate appropriations were made—one for the "Inland waterway between Beaufort Harbor and New River" and the other for the "Waterway between New River and Swansboro," and hence separate reports are made for the two improvements, although one embraces the other.

This waterway is about 22 miles long and originally consisted of tortuous tidal channels winding through the marine marsh, which extends from Swansboro to New River, between the mainland on the one side and the barrier beach or "banks" (which separates it from the ocean) on the other. In the vicinity of the four inlets communicating with the ocean the width of the waterway was several hundred feet and its depth from 12 to 15 feet, while between them its width diminished to about 12 feet in places and its depth to 6 inches at ordinary low water.

The original and existing project, adopted in 1889, is to enlarge the waterway by dredging to a minimum width of 40 feet and minimum depth of 3 to 4 feet at mean high water, at an estimated total cost of $43,000.

Until June 13, 1906, no work except a survey made in April and May, 1901, had ever been done on this waterway, for the reason that an act of the general assembly of North Carolina, ratified February 13, 1889, had incorporated the Wrightsville and Onslow Navigation Company, with the exclusive right to navigate said waterway, as set forth in House Executive Document No. 26, Fifty-second Congress, first session (p. 1147 of the Annual Report of the Chief of Engineers for 1892).

On February 6, 1905, however, a paper was obtained from the two survivors of the four parties named in the charter of said Wrightsville and Onslow Navigation Company, in which paper it was declared that the privileges and franchises granted in said charter had never been exercised and that said privileges and franchises had "to all intents and purposes been surrendered and abandoned.

All obstacles in the way of government improvement having been thus removed, work was begun as soon as plant for the purpose could be spared from other more pressing work.

Amount expended on existing project up to June 30, 1909:

For improvement	$20,825.00
For maintenance	800.00
Total	21,625.00

The expenditures for the year were $3,952.14.

Dredging operations were carried on between August 16 and December 4, 1908, using government plant and hired labor. As a result of this work the project depth now exists throughout the entire waterway. There are, however, several places where the project width has not been secured. It is estimated that the project is about 80 per cent completed.

It is proposed to apply the available balance and the additional appropriation recommended to the maintenance of the present dredge cuts and in obtaining the project width.

The rise and fall of the tide varies from 2.2 to 4 feet in the neighborhood of the inlets to about 1 foot at the points most distant from the inlets.

The commerce of 1908 amounted to 5,208 tons, at an approximate value of $238,735. It consisted principally of cotton, fish, oysters, clams, and fertilizers. This can not be taken as an indication of the amount of commerce that will utilize the waterway now that the proposed movement has been made, for the difficulty and delay incident to navigation were formerly so great that commerce naturally sought other routes.

The improvement of this waterway will probably have no direct effect upon freight rates, but it will afford means of transportation for large quantities of timber, lumber, and miscellaneous products that now have no outlet except by wagon or by the smallest draft boats.

(*c*) *Waterway between Beaufort Harbor and New River* (*i. e., portion between Beaufort and Swansboro*).—Distance from Beaufort to Swansboro, 30 miles, with access at Swansboro to the Atlantic Ocean through Bogue Inlet.

When improvement began in 1886 the governing low-water depth was 18 inches to Swansboro.

The original project is that of 1885, to provide a channel 100 feet wide and 3 feet deep at ordinary low water between Beaufort Harbor and Swansboro, estimated to cost $6,000. This estimate was increased in 1887 to $50,000 and again increased in 1892 to $71,040.

No project was adopted originally for the part beyond Swansboro, but in 1889 a separate project for a channel 40 feet wide by 3 or 4 feet deep over this portion of the waterway was adopted, the estimated cost being $43,000. The act of 1890 made a separate appropriation of $5,000 for this portion of the route, designating it as the "Waterway between New River and Swansboro." (See pp. 1376–1378, Annual Report of the Chief of Engineers for 1891.)

The project is about 85 per cent completed.

The amount expended on present project to June 30, 1909, for improvement is $51,832.56.

No work was done during the fiscal year, the expenditures being for office expenses.

At the close of the fiscal year 1907 the project depth of 3 feet prevailed throughout the entire length of 30 miles between Beaufort Harbor and Swansboro, the dredged channel being 100 feet wide (project width) through one shoal 980 feet long, 60 feet wide through six shoals aggregating 24,696 feet in length, and 40 feet wide through another shoal 874 feet long.

It is reported that no shoaling of any consequence has taken place in the past two years, and hence the above conditions may be taken as the conditions prevailing June 30, 1909.

The tide at Beaufort Inlet at the eastern end of this waterway and at Bogue Inlet (the western end of the portion improved under appropriations for waterway between Beaufort Harbor and New River) has a range of about 3½ feet. Where the tides meet in Bogue Sound the range is only about 1 foot.

The commerce during the calendar year 1908 amounted to 27,372 tons, valued at $1,097,205. The commerce consisted chiefly of lumber, shingles, etc., fish, oysters and clams, rosin and turpentine, miscellaneous farm products, fertilizers, and general merchandise.

It is proposed to use the balance of funds remaining unexpended and the appropriation recommended in maintenance and in increasing the width of the dredged cuts to the project width of 100 feet.

CONSOLIDATED.

July 1, 1908, balance unexpended		$6,333.33
Amount allotted from appropriation by river and harbor act approved March 3, 1909		5,000.00
Amount received as rent during fiscal year		250.00
		11,583.33
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$3,652.14	
For maintenance of improvement	305.79	
		3,957.93
July 1, 1909, balance unexpended		7,625.40
Amount (estimated) required for completion of existing project		42,040.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		25,000.00

The following report of the Board of Engineers on a recent survey of New River is concurred in by the Chief of Engineers and printed in House Document No. 1085, Sixtieth Congress, second session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., July 13, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

The district officer submits estimates of cost for constructing, between the mouth of New River and the town of Jacksonville, channels 5 feet deep at mean low water, and of several widths, via the western channel, which is the route of the present adopted project, and via Cedar Bush Marsh cut, which was the originally improved route. For reasons stated, he recommends a channel 200 feet wide by way of the western channel, at a total estimated cost of $6,692.94, the maintenance of which will require an annual outlay of $800.

The district officer believes tha tthe cross section selected will permit increased tidal action and influence the creation and maintenance of a channel not less than 5 feet deep across the bar. The Board concurs with the division engineer in the opinion that the attainment of this result is at least doubtful. The value of the proposed channel appears to rest principally on its possible usefulness to commerce to be developed along the inland waterway between New River and Swansboro. This waterway having but recently been opened, commercial and navigation conditions have not become sufficiently stable to reliably determine the value of a connecting channel 5 feet deep at mean low water up to Jacksonville. The district officer and division engineer, having given due consideration to this matter, unite in believing that the proposed channel will afford benefits sufficient to justify the United States in constructing it.

While it is obvious that no great commercial returns can be expected from this work, the Board is inclined to believe that the realization of the benefits expected by the district officer and division engineer would recompense the public for the very small expenditure involved, and for this reason it concurs in the recommendations of those officers.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

The commerce on this river for the year 1907 was 24,803 tons, about 20,000 tons of which represents timber and sawed lumber.

There are about 25 launches, or power boats, and 22 sharpies and schooners operating on this river, some operated for pleasure only, and others making runs whenever work can be obtained and engaged in fishing. Since the completion of the dredging in the waterway from New River to Beaufort a large increase in trade between these points is expected, as the fish and oysters from the vicinity of New River will be carried to that point for shipment by rail.

NORTHEAST AND BLACK RIVERS, AND CAPE FEAR RIVER ABOVE WILMINGTON, N. C.

(*a*) *Northeast River.*—Distance from mouth to Bannerman's bridge, 48 miles; to Hallsville, 88 miles; to Kornegay's bridge, the head of navigation, 103 miles.

The original condition when improvement began was a channel badly obstructed by logs, snags, and overhanging trees. The river was navigable to Bannerman's bridge, with governing low-water depth of 6 feet.

The original project of 1889 is still in force, and includes the clearing of the natural channel for small steamers to Hallsville and for pole boats to Kornegay's bridge at an estimated cost of $30,000.

Additional work proposed is for maintenance only, the project having been practically completed.

Amount expended on present project up to June 30, 1909:

For improvement	$10,687.96
For maintenance	11,801.08
Total	22,489.04

The work done during the year consisted of snagging for maintenance and part construction of new hull for snag boat *H. G. Wright.*

As the result of the expenditures to date the channel has been kept cleared, except when it has been impracticable on account of low water or for other causes for the plant to work. Six feet of water can be carried to Bannerman's bridge and 3 feet to Croom's bridge during all stages of the water.

From Croom's bridge to Kornegay's bridge, the head of navigation, the river is so shallow that navigation is practicable only when the water is up. This is liable to occur at any time, but during the summer low stages usually prevail.

The minimum low-water depth to Bannerman's bridge is 6 feet; to Croom's bridge, 3 feet; to Hallsville, 0.5 foot; to Kornegay's bridge (the head of navigation), 0.1 foot.

With the available balance it is proposed to maintain the natural channel to Hallsville.

The additional appropriation recommended is for maintenance.

There is a tidal range of about 2 feet at the mouth of this stream, which decreases to nothing at or a short distance above Bannerman's bridge. The upper portion is subject to freshets of from 8 to 12 feet.

The channel is at present badly obstructed by snags, etc., above the seventy-fifth milepost and is partially obstructed below that point.

The commerce for 1908 amounted to 101,861 tons, valued at approximately $1,618,730. It consisted principally of timber, naval stores, fertilizers, general merchandise, cotton, and miscellaneous farm products.

The commerce is handled on a few boats that make some attempt at regular trips and on a large number of rafts, flats, etc. Hence it is impossible to estimate the commerce with much accuracy.

(*b*) *Black River.*—The original condition when improvement began was a natural channel cleared fairly to Point Caswell and roughly to Lisbon, with governing low-water depths of 4 feet to Point Caswell, 2.5 feet to Haws Narrows, and 1.5 feet to Lisbon.

The original project of 1885 included clearing the natural channel and banks to Lisbon and the cutting off of a few sharp points at bends. It was amended in May, 1893, by omitting that part of the river above Clear Run, and, as amended, was completed September 20, 1895.

The existing project of 1894 is to maintain the natural channel to Clear Run, at an estimated cost of $2,000 per annum.

Amount expended to June 30, 1909:

On previous project mentioned above	$12,358.40
On present project, for maintenance	10,103.18
Total	22,461.58

The expenditures during the year resulted in the removal of the worst obstructions between the mouth and Clear Run.

The result obtained by the expenditures to date has been a cleared channel whenever funds were available, permitting navigation to Point Caswell, 24 miles above the mouth, at all stages, and to Clear Run, 66 miles above the mouth, at stages of 1.5 feet or higher above low water, the governing low-water depths at present being 5 feet to Point Caswell, 2.5 feet to Haws Narrows, 32 miles above the mouth, and 1.5 feet to Clear Run. There is no steamboat navigation above Clear Run. Lisbon, 74 miles from the mouth, is the head of navigation. The low-water stages prevail usually from May to August, inclusive; during the rest of the year the stage is about 5 to 8 feet higher, but the periods of high and low water are by no means the same every year. No further work, excepting maintenance, is now proposed.

It is proposed to expend the available balance for maintenance of the natural channel up as far as Clear Run, and the appropriation recommended is for further maintenance as required.

The commerce during 1908 amounted to 45,998 tons; estimated value $958,409. It consisted principally of timber, general merchandise, naval stores, fertilizers, cotton, and other farm products.

The commerce is handled on a few boats, which make some attempt at regularity, and on a large number of rafts, flats, etc., whose trips are altogether irregular. Hence it is impossible to get the commercial statistics with even fair accuracy.

(*c*) *Cape Fear River above Wilmington, N. C.*—The original condition when work began was a channel badly obstructed above Kellys Cove by logs, snags, etc., and with governing low-water depths of 4 feet to Kellys Cove and 1 foot to Fayetteville.

The original project of January 26, 1881, was to clear the river to Fayetteville and obtain a continuous channel by jettying and dredging, estimated in July, 1893, to cost $275,000 for a channel 4 feet deep to Elizabethtown and 3 feet deep to Fayetteville. It is about 30 per cent completed.

The existing project, adopted by act of June 13, 1902, is to obtain, by canalizing, a low-water depth of 8 feet to Fayetteville, at an estimated cost of $1,350,000.

In consequence of this new project the former project has been abandoned, excepting for the maintenance of the natural channel, pending the construction of locks and dams.

Amount expended on project of 1881 to June 30, 1909:	
For improvement	$134,436.96
For maintenance	20,060.81
Total	154,497.77
Amount expended on project of 1902 to June 30, 1909, for improvement	14,682.23
Total	169,180.00

The work done during the year consisted in removing obstructions in the river between the twenty-sixth and twenty-seventh mileboards caused by the caving of banks, in the partial construction of a new hull for the snagboat *H. G. Wright* for use on this and neighboring streams, inspection, and office work.

The additional appropriation asked for will be devoted to continuing the work of maintenance by open-channel work.

At present the low-water depths are 8 feet to Kings Bluff, 38 miles above Wilmington; 2½ feet to Elizabethtown, 73 miles above Wil-

mington; and 2 feet to Fayetteville, 115 miles above Wilmington. Fayetteville is the head of navigation. Low-water stages prevail from two to four months during each summer, and freshets, which raise the water level from 15 to 50 feet at Fayetteville (the effects lower down being less marked), usually occur as often as once a month during the rest of the year. They do not occur with any regularity, however.

The commerce for 1908 was estimated at 137,620 tons, estimated to be worth $3,960,235.

Locks and dams.—The act of June 13, 1902, appropriated $50,000 for the purchase of sites for locks and dams. A careful survey, consuming more than eleven months' time, was made for the purpose of locating the sites. This survey has been completed, the sites tentatively located, a number of borings made at each site, the locations approved, and prices obtained on all the lands necessary.

The balance of this appropriation for lock and dam improvement, $35,317.77, has been covered into the surplus fund, in accordance with section 10 of the sundry civil act of March 4, 1909.

Abstracts of the titles were made and turned over to the United States district attorney for examination. The titles to the land needed at lower site were approved and the land purchased.

Owing to the fact that Congress has directed a reexamination of this river, with a view to a possible modification of the project, the purchase of the other land has been delayed, as its purchase may not be required.

No estimate is submitted for further work on the existing project for locks and dams, pending action by Congress on the modified plan for this improvement contained in House Document No. 890, Sixtieth Congress, first session, which is based on the reexamination authorized by the river and harbor act in March 2, 1907.

The expenditures to June 30, 1909, on said project for surveys, other preliminaries, and purchasing land at lower site, amounted to $14,682.23.

CONSOLIDATED.

July 1, 1908, balance unexpended	$13,573.95
Amount allotted from appropriation by river and harbor act approved March 3, 1909	10,000.00
	23,573.95
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	5,871.34
July 1, 1909, balance unexpended	17,702.61
July 1, 1909, outstanding liabilities	1,063.28
July 1, 1909, balance available	16,639.33
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	14,000.00

CAPE FEAR RIVER ABOVE WILMINGTON, LOCKS AND DAMS.

July 1, 1908, balance unexpended		$35,526.11
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$208.34	
Covered into the surplus fund	35,317.77	
		35,526.11
Amount (estimated) required for completion of existing project		1,300,000.00

PAMLICO AND TAR RIVERS, NORTH CAROLINA.

(One river, called the Pamlico below Washington, N. C., and the Tar above that point.) Distance from Washington to Greenville, 22 miles; to Tarboro, 49 miles; to Fishing Creek, 56 miles; to Little Falls, 88 miles; to Rocky Mount, 89 miles.

Prior to its improvement, which was begun in 1876, the Pamlico River (that portion of the stream below Washington) was obstructed by war blockades, sunken logs, snags, stumps, and sand shoals.

The governing low-water depths were 5 feet to Washington and perhaps 1 foot to Tarboro, the navigation to which place was practicable during freshet stages only. About 3 feet could be carried to Tarboro during about eight high-water months per year.

The original project for the improvement of the river below Washington was that submitted in December, 1875 (Annual Report of the Chief of Engineers for 1876, p. 361), and adopted by Congress August 14, 1876, and had for its object to provide 9 feet at low water, from Washington to its mouth, by dredging and the removal of piles and obstructions at an estimated cost of $28,050. In the project proper the proposed draft to be provided was not specified, but work under the project was devoted to securing 9 feet at mean low water. Under this project the sum of $18,000 was appropriated, of which $17,877.12 was expended; the remainder, $122.88, was transferred to the improvement of the Pamlico and Tar rivers, when the improvements were combined in 1880.

The Tar River (that portion of the stream above Washington), prior to improvement, was obstructed by sunken logs, piles, wrecks, stumps, snags, and trees in the channel, and overhanging trees along its banks. The original project for this portion of the stream was that of 1879 (Annual Report of the Chief of Engineers for 1879, p. 700) for the removal of obstructions between Washington and Tarboro at an estimated cost of $10,000. An appropriation of $3,000 was made for this purpose in 1879, of which $2,867.27 was expended, leaving a balance of $132.73, which was transferred to the joint improvement.

In 1889 the project was extended to clear the natural channel above Tarboro, 34 miles, to Little Falls, and the estimate was increased $16,200, making the total estimate $92,200.

The present project is that of 1875 (for Pamlico River), and of 1879, 1889, and 1907 (for Tar River), somewhat modified to secure a channel 100 feet wide and 9 feet deep at mean low water to Washington; thence a channel 60 feet wide and 4 feet deep at low water for 22 miles farther, to Greenville; thence a channel 60 feet wide and 20 inches deep at low water for 26 miles farther, to Tarboro; thence to keep clear of obstructions the natural channel 34 miles farther, to Little Falls, 2 miles below Rocky Mount, N. C.

The project as modified by act of March 2, 1907, changed the depth between Washington and Greenville from 3 to 4 feet at mean low water, at an estimated cost of $3,800.

The work for the year was for maintenance and consisted in removing the worst obstructions from the channel between Washington and the mouth of Fishing Creek, and making surveys of the

shoals immediately below Greenville, and also in the vicinity of the Norfolk and Southern Railway bridge at Washington.

Expended prior to 1876 on previous projects		$15,000.00
Expended on present project to June 30, 1909:		
For improvement	$149,875.33	
For maintenance	23,485.42	
		173,360.75
Total		188,360.75

The project of 1875, with its various modifications, is completed, and at the beginning of the fiscal year there was a channel to Washington 100 feet wide and 9 feet deep at mean low water; thence to Greenville a channel 60 feet wide and 4 feet deep at low water, which is in good condition except for a small amount of snagging required. The dredged cuts below and above Washington have slightly deteriorated during the year.

Above Greenville the river has deteriorated for lack of maintenance and is navigable only during freshet stages of variable duration, extending over six or eight months of the year.

It is proposed to apply the available balance, together with the appropriation recommended, to maintenance of the improvement, both above and below Washington.

The stream is nontidal. Below Washington the only surface variations of importance are due to the wind, with an extreme range of 3 feet under normal conditions. Long protracted easterly or westerly winds sometimes cause variations of 7 or 8 feet. The variations of the upper portion of the river are affected by freshets only.

The head of navigation is Dunbar's bridge, 108 miles from the mouth.

The commerce for the year 1908 amounted to 353,429 tons, valued at approximately $7,909,369 (a decrease as compared with 1907 of 74,959 tons). It consisted principally of cotton, cotton-seed products, grain, potatoes, wood, timber, lumber, fertilizer, and general merchandise.

The tendency of the improvement is to keep down freight rates.

Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 ..... $10,000.00

ROANOKE RIVER, NORTH CAROLINA.

Originally the navigable channel to Indian Highland bar, 67 miles above the mouth, was 10 feet deep at mean low water, and thence to the town of Weldon, which is 129 miles from the mouth, the minimum depth was 2½ feet at the same stage.

The project, adopted in 1871, contemplates a channel with a least width of 50 feet from Hamilton to Weldon, 5 feet deep at mean low water, and the removal in the lower portion of the river, below the former point, of such obstructions as may be necessary to accommodate vessels navigating North Carolina sounds. The estimated cost of the work was $269,000.

The expenditures to June 30, 1909, amounted to $240,005.42, of which amount $11,315.19 has been expended in maintenance and $1,355 was received from sales. The project is about 80 per cent

completed. The channel obstructions have been removed, and a channel depth of 4 feet at mean low water over the projected width has been provided between Hamilton and Weldon. On June 30, 1908, vessels drawing 8½ feet could go as far as Hamilton, and beyond that point, to within a short distance of Weldon, 4 feet could be carried at mean low water. A bar is forming at the mouth of the river, due to deposits brought down by freshets, and this has somewhat diminished the depth that could otherwise be carried to Hamilton. The upper river is subject to heavy freshets, which cause the only variation in the level of the water surface. Weldon, situated about 129 miles from the mouth, is the head of navigation.

The only work done during the fiscal year was in the nature of maintenance and consisted in the removal of sunken and overhead obstructions.

The commerce has varied considerably since the improvement was undertaken, the maximum amount of freight transported having been in 1891, when it was 376,181 tons. Since then it has decreased, and for the calendar year 1908 it was reported at 78,775 tons, valued at $1,402,080. The principal item of shipment is timber.

The depletion of the forests and the development of railroads in the territory tributary to the river have served to reduce the volume of water-borne freight in recent years.

It has not been found possible to ascertain what effect, if any, the improvement has had upon freight rates.

The balance available and the amount estimated for will be applied in maintaining the improvement by keeping the channel clear of logs, snags, and similar obstructions.

July 1, 1908, balance unexpended	$3,962.48
Received from sales during fiscal year	3.25
	3,965.73
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,616.15
July 1, 1909, balance unexpended	2,349.58
Amount (estimated) required for completion of existing project	41,925.88
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	5,000.00

SCUPPERNONG RIVER, NORTH CAROLINA.

From the mouth to Columbia is 5 miles; to Spruill's bridge, 23 miles.

Before work was commenced on the river there was only about 5 feet across the bar at its mouth. The upper portion was obstructed by logs, snags, stumps, overhanging growth, and abrupt bends, permitting navigation by small vessels only.

The original project, adopted in 1876, was to dredge the bar, make cut-offs at sharp bends, and remove obstructions so as to obtain a channel 60 feet wide and 9 feet deep at low water up to Spruill's bridge.

The present project, adopted by act of June 13, 1902, provides for dredging a channel 3,400 feet long, 150 feet wide, and 9 feet deep at mean low water across the bar at the mouth of the river, at a cost of $14,000.

The project is about 70 per cent completed.

Expended prior to 1902 on previous project		$8,000.00
Expended on present project up to June 30, 1909:		
For improvement	$11,500.00	
For maintenance	4,001.32	
		15,501.32
Total		23,501.32

There was no work done during the fiscal year 1909. The expenditures, $31.35, were for outstanding liabilities of the previous fiscal year and for travel expenses incurred in an examination of a bridge at Columbia.

At the close of the fiscal year 1909, the conditions so far as known are a channel 9 feet deep at mean low water, 90 feet wide for 2,700 feet of its length, and 130 feet wide for 700 feet of its length across the bar at the mouth of the river; thence to Cross Landing, 14 miles above, a good open channel of 7 feet at mean low water, free from obstacles; thence to Spruill's bridge, 9 miles farther, 7 feet at mean low water, but the river in many places is narrow and crooked and obstructed by overhanging trees on the banks and by logs and snags in the channel.

It is proposed to apply the available balance, together with $2,500 allotted from act of March 3, 1909, for preservation and maintenance of rivers and harbors and the additional appropriation recommended to the completion of the project and to maintenance.

This is a nontidal stream with no slope, the oscillations of the surface being controlled by the winds.

Spruill's bridge. 23 miles from its mouth, is the head of navigation, to which point 7 feet can be carried at mean low water.

The commerce for 1908 amounted to 12,515 tons, valued at approximately $215,200, a decrease of 56,115 tons below last year. The principal falling off was caused by the completion of the Norfolk and Southern Railway to Columbia and the discontinuance of the steamboat line between Columbia and Edenton.

July 1, 1908, balance unexpended		$1,530.03
Amount allotted from appropriation by river and harbor act approved March 3, 1909		2,500.00
		4,030.03
June 30, 1909, amount expended during fiscal year, for maintenance of improvement		31.35
July 1, 1909, balance unexpended		3,998.68
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		2,500.00

SOUTH RIVER, NORTH CAROLINA.

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 954, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., April 6, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

In the within report on a survey of South River, North Carolina, the district officer submits plans for improving the same from its mouth to Aurora, N. C., with a view to

obtaining depths of 6, 7, and 8 feet, which he estimates will cost $4,250, $15,800, and $31,700, respectively, these estimates being based on a channel width of 100 feet.

While the recommendation of the district officer in his report on preliminary examination of this locality, in which the Board concurred, was favorable for a depth of 8 feet, it appears from the above that the cost of excavating a channel of this depth will be more than twice the cost of a channel 7 feet in depth. The depths referred to in the estimates are below mean low water. As there is no tidal variation in this stream and the fluctuations of level are dependent upon rains and winds, a depth exceeding that found at mean low water is available during the greater portion of the year. The district officer states that the normal level of the water is probably nearly 1 foot above the adopted level of mean low water, and such being the case, it would appear that the project proposed by him for a depth of 7 feet will be sufficient for the lumber barges drawing 8 feet for the greater portion of the year.

In view of the statements made in the reports on preliminary examination and survey as to the benefits which may be expected from providing an improvement adequate to the class of commerce using this waterway, and having in mind the moderate cost of the project proposed by the district officer, the Board concurs with the district officer and the division engineer in believing that it is advisable for the United States to undertake this improvement. To promote the efficiency of the channel the Board believes that some easement of the bends may be advisable, as suggested by the division engineer, and for this reason recommends an appropriation of $16,000, which it is believed will cover the slight additional expense thus necessitated.

For the Board:

R. L. HOXIE,
Colonel, Corps of Engineers,
Senior Member Present.

The commerce of the stream is reported to be about 80,000 tons, of which about 62,000 tons is lumber. An unknown part of this lumber originates on Bond Creek, a tributary of South River, and as the depth is already 8 feet or more in this stream and in South River below its mouth, its commerce would not be benefited by the improvement now under contemplation. It is stated within that if a depth of 8 feet is made available additional sawmills will be established at Aurora and that the existing and prospective traffic in this item of commerce will be greatly benefited, as barges destined for Norfolk by way of the canal can be loaded to their full capacity.

INLAND WATERWAY FROM PAMLICO SOUND TO BEAUFORT INLET, NORTH CAROLINA.

Distance from the 10-foot mean low-water contour in Adams Creek (a tributary of the Neuse River) to the head of Adams Creek is about 7 miles; from the head of Adams Creek across the country to the head of Core Creek is about 3 miles; from the head of Core Creek to the mouth of Core Creek is about 4 miles; and the distance from the mouth of Core Creek to the 10-foot depth at mean low water in the Newport River is about 4 miles, making the total distance over which dredging will be required about 18 miles.

At the time of the adoption of the existing project a low-water depth of about 5 feet could be carried from the 10-foot contour in Adams Creek to near its head; from the head of Adams Creek to the head of Core Creek is across dry land; from the head of Core Creek to its mouth the creek is practically bare at low water; and from the mouth of Core Creek to the 10-foot contour in Newport River the low-water depth formerly averaged about 6 feet.

The present and only project, adopted by act of Congress approved March 2, 1907, contemplates securing, by dredging, a channel 10 feet deep at low water from Pamlico Sound to Beaufort Inlet via Adams and Core creeks, said channel to have a minimum bottom width of 90

feet through dry land with side slopes of 1 to 2½, a minimum bottom width of 125 feet with side slopes of 1 to 3 through narrow parts of the creek and river portions, and a minimum bottom width of 250 feet with side slopes of 1 to 3 in wide parts of creeks and sounds, at an estimated cost of $550,000.

Amount expended on project for improvement to June 30, 1909, $101,012.90.

The work of the year consisted of laying out and superintending the work, purchasing 227.45 acres of land for the right of way, removing under contract 1,250,827 cubic yards of material from the prescribed cross section, completing 34,182.3 feet of channel, which varies in width from 90 to 250 feet, and starting the work of the construction of a steel highway bridge over Core Creek under contract.

The river and harbor act of March 2, 1907, authorized continuing contracts for completing the project in the sum of $350,000, of which $45,000 is yet to be appropriated.

The funds in hand will be used in completing the waterway, and the additional appropriation recommended will be applied to work of maintenance.

References: Pages 1393 and 1394, Report of the Chief of Engineers for 1904, and House Document No. 84, Fifty-ninth Congress, second session.

July 1, 1908, balance unexpended	$358,253.18
Amount appropriated by sundry civil act approved March 4, 1909	135,000.00
	493,253.18
June 30, 1909, amount expended during fiscal year for works of improvement	89,266.08
July 1, 1909, balance unexpended	403,987.10
July 1, 1909, outstanding liabilities	48,611.97
July 1, 1909, balance available	355,375.13
July 1, 1909, amount covered by uncompleted contracts	279,868.49
Amount (estimated) required for completion of existing project	45,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	20,000.00

WATERWAY CONNECTING SWAN QUARTER BAY WITH DEEP BAY, NORTH CAROLINA.

Swan Quarter, the county seat of Hyde County, N. C., is situated at the head of Swan Quarter Bay, in the southwestern part of the county, and on the north shore of Pamlico Sound, near the mouth of the Pamlico River. Just to the westward of Swan Quarter Bay, and separated from it by the low marshes known as Judith Marshes and Judith Island, is a small landlocked harbor, called Deep Bay. This opens into Rose Bay, and the latter into the Pamlico River a few miles above its mouth.

The nearest large cities and railroad stations to Swan Quarter are Washington, 50 miles distant, on the Pamlico River, and Bellhaven, 30 miles distant, on the Pungo River, a tributary of the Pamlico, traffic to both places having to ascend the Pamlico River.

The following report of the Board of Engineers is concurred in by the Chief of Engineers and printed in House Document No. 445, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., October 7, 1907.

Respectfully returned to the Chief of Engineers, U. S. Army.

The district officer submits estimates for channels of 6, 7, and 8 feet in depth, amounting to $14,575, $19,525, and $27,225, respectively, with estimates for maintenance of $900, $1,500, and $2,000, respectively. He believes the commerce involved is sufficiently large to justify the cost of a 6-foot channel and that this depth will meet the demands of navigation, in which views the division engineer concurs.

In the opinion of the Board the present commerce of 10,000 tons, which is dependent entirely upon water transportation, with reasonable prospects for an increase, warrants the expense necessary to provide the protected 6-foot channel contemplated, and no greater depth is now required. It therefore recommends the adoption of the project proposed by the district officer at an initial cost of $14,575, and $900 annually thereafter for maintenance.

WACCAMAW RIVER, NORTH CAROLINA AND SOUTH CAROLINA.

In 1880 this stream was navigable for 12-foot-draft boats at all stages of water from Georgetown, 23 miles, to Bull Creek, and at high water 4 miles farther, to Bucks lower mills; thence for 7-foot-draft boats, at high water, 22 miles farther, to Conway; thence it possessed an obstructed channel for 3-foot-draft boats, at ordinary winter water, 68 miles, to Reeves Ferry; thence an obstructed channel, with 3 feet at high water, for 30 miles, to Lake Waccamaw.

The project of improvement, adopted in 1880, provides for a channel 12 feet deep at all stages of water, with 80 feet bottom width from the mouth of the river to Conway; thence a cleared channel to Lake Waccamaw.

The original estimated cost was $29,370, which was revised in 1885 and increased in the annual report of that year to the present figure, $138,400. In the Annual Report of the Chief of Engineers for 1886, page 170, maintenance is estimated at $4,000 per year after completion of improvement.

The total expenditure to June 30, 1909, was $143,552.79. The river had been cleared of snags to a distance of 128 miles above the mouth, and this portion of the river had been frequently resnagged as appropriations permitted, 46,201 snags, etc., having been removed since June 30, 1884. Some work had been done toward increasing the original depth on eight shoals below Conway. As nearly as can be determined from the records, about $75,977.81 had been expended in originally snagging the lower 128 miles of the river and in constructing pile and plank dikes at eight shoals, and $35,435.11 in maintenance.

Dredging was begun in 1903 to obtain a 6-foot channel below Conway and to straighten the river by cutting through the worst bends. The expenditure during the year was for continuing this work at Thoroughfare Cut-off; the total amount of material removed during the year was 23,731 cubic yards, and the aggregate to June 30, 1909, 139,500 cubic yards.

The approved project is about 85 per cent completed.

The available depths reported as now existing do not differ greatly from the original depths. At mean low water about 12 feet can be

carried to Bucksville, 34 miles above the mouth; 6 feet to Conway, 50 miles; about 2 feet to Wortham's bridge, 97 miles. At high water large side-wheelers can go to Red Bluff, 74 miles, and small boats to Reeves Ferry, 117 miles.

Lake Waccamaw, 147 miles above the mouth, is the head of navigation.

The usual variation in water level is about 7.5 feet at Conway, 50 miles above the mouth, and about 12 feet at Star Bluff, 84 miles above the mouth.

The appropriation recommended will be applied to dredging and snagging.

The tidal influence at low water extends 97 miles above the mouth.

Commercial statistics.

Year.	Tons.	Value.	Year.	Tons.	Value.
1902	141,686	$1,844,019	1906	244,920	$3,720,000
1903	143,813	1,884,700	1907	295,135	4,050,550
1904	190,435	2,119,040	1908	98,743	3,258,677
1905	207,680	2,665,917			

The vessels engaged in traffic on this river are steamers and tugboats of from 10 to 550 tons, seagoing schooners of from 300 to 500 tons, pole boats, rafts, etc. The additional work proposed is necessary to make the improvement available.

No new line of transportation was established during the year.

For references to examinations and surveys, see page 246, Annual Report of the Chief of Engineers, 1904.

It has been found impossible to obtain information concerning the effect of the improvement on freight rates.

Under the existing projects a consolidated estimate of $44,000 is submitted for works of improvement and maintenance during the coming year on the Waccamaw and Little Pedee rivers, these streams having been appropriated for jointly.

Report of a survey of Waccamaw River is printed in House Document No. 514, Fifty-eighth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, February 3, 1904.

SIR: I have the honor to submit herewith for transmission to Congress reports of April 8, 1903, by Capt. J. C. Sanford, Corps of Engineers, and of December 8, 1903, by Capt. G. P. Howell, Corps of Engineers, on preliminary examination and survey, respectively, of Waccamaw River, North Carolina and South Carolina, authorized by the river and harbor act approved June 13, 1902.

Waccamaw River is at present being improved under a project which provides for a channel 12 feet deep at all stages, with 80 feet bottom width, from the mouth of the river to Conway, S. C., and thence to Lake Waccamaw a channel cleared of snags and other obstructions. In the opinion of Captain Sanford the river is worthy of improvement to the extent contemplated by the present project, and that a new project should not be entered upon until the present one is completed.

The commerce of the Waccamaw is reported to be about 120,000 tons annually, valued at about $1,600,000.

In his survey report of December 8, 1903, Captain Howell presents plans and estimates for work as follows: For dredging a channel 100 feet wide from the

mouth to Conway, with depth at mean low water of 6 feet, $40,000; with depth of 9 feet, $70,000; and with depth of 12 feet (the present project depth), $120,000. Captain Howell recommends that the project for a 12-foot channel be maintained and that this estimate of $120,000 be adopted. The annual cost of snagging on the river above Conway is estimated at $5,000.

An alternative recommendation is submitted by the local officer in favor of a modified plan, which provides for a 12-foot channel to a point near Bucksville, and 6 feet thence to Conway, at an estimated cost of $50,000. For the reasons given in his indorsement of December 11, 1903, the division engineer, Lieut. Col. James B. Quinn, Corps of Engineers, recommends for adoption this last-named plan and estimate.

These papers have been referred for consideration and recommendation by the Board of Engineers for Rivers and Harbors, as provided in sections 3 and 14 of the act of June 13, 1902, and attention is respectfully invited to the Board's report of January 18, 1904, in seventh indorsement thereon. I concur in the conclusions of the Board, as follows:

"Having duly weighed the cost against commercial benefits, the Board is of opinion that it is advisable to continue the improvement of Waccamaw River, South Carolina, with a view to a channel 100 feet wide and 12 feet deep from its mouth to Bucksville, a distance of 36 miles, and a channel of the same width and 6 feet deep from Bucksville to Conway, a distance of 14 miles. The Board is further of opinion that it is advisable to continue snagging operations above Conway, but to a less extent than is indicated by the estimate of the district officer. The following is an estimate of cost of the work deemed advisable by the Board:"

12-foot channel, 100 feet wide, from mouth to Bucksville	$15,000
6-foot channel, 100 feet wide, from Bucksville to Conway	35,000
Total	50,000
Annual cost of maintenance, including snagging above Conway	5,000

Very respectfully, your obedient servant,

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

Hon. WM. H. TAFT,
Secretary of War.

CHARLESTON HARBOR, SOUTH CAROLINA.

There were originally four channels across the bar, the deepest having about 12 feet depth at low water. Commerce was then using the Pumpkin Hill channel, about 3 miles south of the present jetty channel. Where the present jetty channel is situated there was then the Swash channel, with a best depth of 10½ feet of water, too crooked for safe use. The natural channels were shifting in position and variable in depth.

The original project, adopted in 1878, provided for establishing and maintaining, by means of two jetties and auxiliary dredging, a low-water channel of not less than 21 feet depth across the bar. The Swash channel was selected for improvement. The estimated cost was $3,000,000.

In 1888 it became necessary to modify the height of the crest line of the jetties and to revise the estimate. This increase in the estimate was largely due to the fact that money had been appropriated so slowly that reasonable contract prices could not be obtained. The annual appropriation up to that time had been only 5½ per cent of the original estimate. In the revised project the jetties were increased in height and length, but no change was made in their position or distance apart. The revised estimates were $4,380,500 if the

jetties were brought up to low-water level throughout, and $5,334,500 if brought up 3 feet higher. The former estimate was adopted by Congress in the river and harbor act approved July 13, 1892.

The present project, adopted by the river and harbor act approved March 3, 1899, provides for obtaining a channel at the entrance to Charleston Harbor not less than 26 feet deep at mean low water (mean range of tide about 5.2 feet) and 600 feet wide, by constructing a large seagoing suction dredge, at a cost not exceeding $150,000, and operating her, together with the existing dredge *Charleston*, for three years. The estimated cost of constructing the new dredge and operating it, as above, was $285,000. Of this amount $175,000 had been appropriated prior to the enactment of the river and harbor act of June 13, 1902, which made available an additional sum of $208.000, increasing to $383,000 the amount authorized for the project for the new dredge and its operation. The entire amount authorized has been appropriated.

The total expenditures to June 30, 1909, were $4.653,057.59, including about $2,500 expended at Sullivans Island and $10,000 at Mount Pleasant; of this sum, $7,823.23 was derived from miscellaneous sources, such as rental of dredge and auction sales. Of this amount, $4,640,557.59 has been expended on the original projects and on maintenance.

Dredging during the year provided the full project width. A good channel exists of not less than 26 feet at mean low water and at least 600 feet wide throughout the whole length of the improved portion, although a slight shoaling occurred in the outer portion during the year. The mean tidal range is 5.2 feet.

The operations during the year were for maintenance.

The river and harbor act of March 3, 1905, authorizes the Secretary of War, in his discretion, to cause the new dredges employed on this work to be utilized, at such times as they are not employed in dredging on the outer bar, for dredging in the channels between said outer bar and the city of Charleston.

For references to examinations and surveys and to projects see page 257, Annual Report of the Chief of Engineers for 1904.

COMMERCIAL STATISTICS.

Foreign commerce.

Year.	Aggregate registered tons.	Value.	Year.	Aggregate registered tons.	Value.
1889	211,208	$16,744,951	1899	174,525	$6,385,168
1890	224,962	16,041,397	1900	150,631	11,170,910
1891	274,149	23,110,664	1901	141,008	5,276,757
1892	169,379	11,829,607	1902	219,069	7,095,294
1893	193,336	11,940,129	1903	142,196	5,237,119
1894	208,169	11,560,372	1904	146,966	6,100,295
1895	140,938	10,586,326	1905	106,351	3,337,088
1896	158,325	11,785,846	1906	132,400	4,165,567
1897	226,750	12,106,763	1907	174,219	6,036,866
1898	214,180	10,956,250	1908	187,044	6,969,606

Commerce through Charleston Harbor, ocean entrance.

Year.	Total imports and exports.	Value.
	Tons.	
1901	784,812	$29,454,515
1902	822,845	34,746,997
1903	685,903	47,659,427
1904	880,596	49,994,894
1905	858,016	51,631,040
1906	835,360	56,301,096
1907	722,338	56,138,444
1908	651,232	61,444,244

Regarding effect on freight rates since improvement began in 1878, the only change that seems due to the improvement is a lowering of about 12½ cents per ton on business done by coastwise sailing vessels.

The additional work proposed is for maintenance.

July 1, 1908, balance unexpended	$17,312.87
Amount allotted from appropriation by river and harbor act approved March 3, 1909	25,000.00
	42,312.87
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	12,047.23
July 1, 1909, balance unexpended	30,265.64
July 1, 1909, outstanding liabilities	3,247.09
July 1, 1909, balance available	27,018.55

Report on a survey is printed in House Document No. 499, Fifty-eighth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, January 27 1904.

SIR: I have the honor to submit herewith a report, dated April 9, 1903, by Capt. J. C. Sanford, Corps of Engineers, on preliminary examination of Charleston Harbor, South Carolina, to ascertain the advisability of extending the jetties with a view to providing a harbor of refuge. This report is made in pursuance of a requirement in the river and harbor act of June 13, 1902, and Captain Sanford is of opinion, concurred in by the division engineer, Lieut. Col. J. R. Quinn, Corps of Engineers, that the locality is not at the present time worthy of improvement as a harbor of refuge by further jetty extension. The report has been reviewed, under the provisions of sections 3 and 14 of the said act, by the Board of Engineers for Rivers and Harbors, which has visited the locality, through a committee, and held a public hearing, at which interested parties were afforded an opportunity to express their views.

Pursuant to the recommendation of the Board in report of June 19, 1903, the district officer, Capt. G. P. Howell, Corps of Engineers, has prepared estimates of the cost of dredging channels of 28 feet and 30 feet depth, 1,000 feet wide outside the jetties and 500 feet wide inside the jetties, and for extending the north jetty. Further consideration has been given the matter by the Board, final report being made in indorsement of December 22, 1903, in which it concludes that it is advisable for the United States to undertake the improvement of Charleston Harbor by means of dredging with a view to producing an entrance channel 28 feet deep at mean low water, 1,000 feet wide beyond the jetties and

500 feet wide between them, at an estimated cost of $371,616, the annual cost of maintenance being estimated at $40,000.

I concur in the opinion of the Board.

Very respectfully, your obedient servant,

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

The following is printed in Senate Document No. 300, Sixty-first Congress, second session:

WAR DEPARTMENT,
Washington, January 14, 1910.

SIR: In response to Senate resolution dated December 10, requesting the Secretary of War "to transmit to the Senate an estimate of the cost of further improving Charleston Harbor, South Carolina, so as to secure a depth of 30 feet at low water in the harbor and across the bar, together with any data relating thereto that may be on file in his department," I have the honor to transmit herewith copy of a report made by Captain Adams, Corps of Engineers, with accompanying blueprint, which it is thought affords the information desired.

In submitting this report the Chief of Engineers, U. S. Army, remarks as follows:

"These data were prepared by the district engineer officer in connection with the work of making an examination and survey of Cooper River in pursuance of a provision in the river and harbor act of March 3, 1909, and involved no expense to the United States."

Very respectfully,

J. M. DICKINSON,
Secretary of War.

The PRESIDENT OF THE SENATE.

WAR DEPARTMENT,
UNITED STATES ENGINEER OFFICE,
Custom-House, Charleston, S. C., December 31, 1909.

GENERAL: Further improvement of Charleston Harbor, South Carolina, so as to secure a depth of 30 feet at low water in the harbor and across the bar is entirely practicable. The problem resolves itself into two parts: First, to secure a channel 30 feet deep; and, second, to maintain such channel. Each result may be accomplished in either of two ways: (*a*) By modification of the jetties, supplemented by dredging, or (*b*) by dredging alone.

TO SECURE A 30-FOOT CHANNEL.

Tentative estimates show that to secure a 30-foot channel by modification of the jetties, supplemented by dredging, will be far more expensive than to secure the same channel by dredging alone. There are no considerations sufficient to justify the great additional expense. The method by dredging alone is selected as the most advantageous.

A 30-foot channel provided by dredging alone should be of the following widths: From the sea to the mouth of the jetties, 1,000 feet wide, with side slopes 1 on 10; from the mouth of the jetties to deep water in the harbor, 600 feet wide, with the same side slopes. Also, the present alignment of the entrance channel should be modified. This alignment, which requires ships to enter on Cumming Point range, turning at the mouth of the jetties and proceeding on Fort Sumter range, is not that contemplated by the project; it was authorized as a temporary expedient, with a view to securing a 26-foot channel at the earliest practicable date; and it permitted securing a 26-foot channel much sooner than the same channel could have been secured on the projected alignment straight to sea on the Fort Sumter range.

But the Cumming Point alignment, while excellent for the purpose stated, should not be considered as the proper permanent position for the entrance channel. In undertaking further improvement, the new project should contemplate carrying a channel straight to sea on the Fort Sumter range, as orig-

inally proposed, and of the dimensions stated above, thus giving a direct and commodious entrance.

Under the conditions laid down above, computation shows that to secure the 30-foot channel there are to be removed, by place measurement, 2,493,452 cubic yards of material, largely sand, with some mud and a small amount of clay. An estimate should not, however, be based strictly upon place measurement, as dredges working at sea will depart somewhat from the established ranges, and must excavate somewhat in excess of projected depth in order to insure securing that depth. For these variations an allowance of 25 per cent in excess of place measurement is not too large. Adding this allowance gives 3,116,815 cubic yards as the basis for estimate.

In conjunction with the work required on the ocean bar and in the jetty channel there will be required a small amount of dredging within the harbor. A shoal makes out from White Point, at the junction of Cooper and Ashley rivers, which will somewhat interfere with the movement of deep-draft vessels from the lower harbor to the city front, or to the navy-yard. This obstructive condition can be remedied by the removal of 50,000 cubic yards of material.

For securing a 30-foot channel from the sea to the water front, by dredging alone, the following estimate is submitted:

3,116,815 cubic yards at the ocean entrance	$311,681.50
50,000 cubic yards on the shoal at White Point	5,000.00
	316,681.50
Add about 10 per cent for emergent contingencies	33,318.50
Total	350,000.00

It will be noted that this estimate is smaller than any estimate previously submitted for the same or similar work. In view of this fact it should be made clear that the following considerations enter into the determination of the figures given:

Three seagoing dredges, the *Sumter*, the *Charleston*, and the *Winyah Bay*, are the property of this district, and to accomplish the work within the estimate stated above it is proposed that the *Sumter* and the *Charleston* shall be placed immediately upon this work and kept continuously at work until the channel is secured. It is also proposed that the dredge *Winyah Bay* shall be available at the outset for a limited amount of work on the shoalest portions of the bar, where the larger dredges can not work to advantage. And it is assumed that these dredges are in good condition. The *Winyah Bay* is; the *Sumter* and *Charleston*, by reason of recent large expenditures, in other districts, applied to rebuilding, should be. Further, as an essential condition of the estimate, it is assumed that funds will be provided in such amounts and at such times as will permit continuous and vigorous prosecution of the work from inception to completion.

Under these assumptions the 30-foot channel can be secured within the estimate stated and within three years after work is begun.

TO MAINTAIN THE 30-FOOT CHANNEL.

Examination of the present condition of the channel and the past history of this improvement lead me to believe that modification of the jetties, either by raising the inner ends or by extending seaward, will be in no sense essential to the maintenance of a 30-foot channel. Tentative estimate indicates clearly that modification with a view to accomplishing that end will be far more expensive than the anticipated work of maintenance by dredging alone. This problem is not entirely determinate, and it can not at this time be finally stated that the channel should be maintained by dredging alone; but all considerations point to that conclusion, and lead to the belief that maintenance by dredging will be less expensive than maintenance against which is charged the interest on the cost of further jetty construction, plus the charge for supplementary dredging.

Dredging alone is selected as the basis for estimating cost of maintenance. The work can be accomplished by keeping one seagoing dredge, preferably the *Charleston*, continuously in commission and in operation whenever required, which will cost, allowing for repairs and upkeep, approximately $50,000 per year. It is considered that this figure is ample and is subject to reduction.

RÉSUMÉ.

To secure 30-foot channel within three years..... $350,000
To maintain 30-foot channel, annually thereafter, not to exceed..... 50,000

Very respectfully,

L. M. ADAMS,
Captain, Corps of Engineers.

The CHIEF OF ENGINEERS, U. S. ARMY.
(Through Division Engineer, Southeast Division.)

WINYAH BAY, SOUTH CAROLINA.

This large bay is connected with the ocean by a passage between the shores of North and South islands 2½ miles long, 1 mile wide at the bay, three-fourths mile wide at the gorge, and 1¼ miles wide at the ocean, or southeasterly, end of North Island. Through the passage, which trends north-northwest and south-southeast, there was a bold channel 36 feet deep at the bay, retaining a depth of not less than 20 feet until about 3,000 feet southerly from the end of North Island and of not less than 15 feet to a point about 1 mile south of the island, where the channel divided into two. One of these two channels, known as Main channel, continued 3¼ miles farther, through extensive shoals, to the 18-foot contour in the ocean. This channel was south-southeast and in alignment with the main channel through the straits. The other, known as Bottle channel, after flowing about 2,500 feet southeasterly, 1,500 feet easterly, and about 3,000 feet northeasterly, reached the 18-foot contour in the ocean at a distance of about 1½ miles in a direction from the point of separation from the main ship channel almost at right angles with the direction of that channel and of the channel through the passage. At mean low water the depth on the crest of the bar was variable in both channels and about 7 to 9 feet in Main channel and 6 to 8 feet in Bottle channel. The mean range of tide is 3½ feet.

The present project, adopted in 1889, provides for the construction of two jetties, springing, respectively, from North and South islands and converging toward the bar, the jetties to consist of mattress foundation and a superstructure of large riprap stone raised to a height of 6 feet above mean low water, the south jetty to extend due east across the bar and the north jetty to converge toward it, so as to produce the necessary contraction on the bar. The depth to be secured is 15 feet at mean low water. The river and harbor act of June 3, 1896, authorized the completion of the work under continuing-contract system, at a cost not exceeding $1,996,250, in addition to the $20,000 appropriated by the act. The entire amount has been appropriated by sundry civil acts since that date. The project was extended by the river and harbor act approved June 13, 1902, to permit dredging at the shoal places in Winyah Bay, between the entrance and the city of Georgetown, S. C., over which the least channel depths might at any time be less than at the entrance to the bay, provided that the expenses of this dredging, added to that of improving the entrance to the bay, should not exceed the total amount authorized under the continuing-contract system.

The total expenditures to June 30, 1909, were $2,491,909.33, of which $428,750 was appropriated prior to June 3, 1896. Of this amount $6,252.36 was derived from miscellaneous sources, such as

rent of dredge, auction sales, etc. For maintenance, $93,791.79 has been spent. The jetty work, which since June 3, 1896, has been under a continuing contract, has been completed. The north jetty extends a distance of 11,139 feet from the shore end, with crest from 4½ to 6 feet above mean low water, except the outer 100 feet, which is submerged. The south jetty extends a distance of 21,051 feet from the shore end, with crest at heights varying from 10 feet above mean low water at the inner end to nothing at the outer end. The stone superstructure has practically no top width. A stone mound, 50 feet long, 30 feet wide, and 12 feet above low water had been constructed to mark the outer end of the south jetty. The seagoing suction dredge *Winyah Bay* has been built, and this dredge and the similar dredge *Charleston* has removed 1,553,271 cubic yards of material from the entrance channel and 1,179,274 cubic yards of material from the eastern channel in upper Winyah Bay and Sampit River shoal. Spur dikes have been built to protect the South Island beach. A mud dike has been built from the high land on South Island to the high land near the Santee River to prevent the tides from cutting around the shore end of the south jetty, and the stonework of the jetty has been extended about 2,600 feet by a work of sheet piling covered with mud to connect with this dike.

The approved project was practically completed by June 30, 1909. Slight shoaling has occurred during the year in portions of the channel where the depth is slightly less than 15 feet; these shoal places will be removed during the coming fiscal year.

The appropriation recommended will be applied to dredging for maintenance of the improvement.

Commercial statistics.

Year.	Tons.	Value.	Year.	Tons.	Value.
1891	261,370	$8,071,600	1901	247,989	$8,457,906
1892	271,986	.....	1902	387,471	9,310,682
1893	268,640	.....	1903	368,502	9,359,581
1894	293,822	.....	1904	369,774	9,546,843
1896	171,059	6,228,350	1905	363,916	10,401,879
1897	149,374	5,817,950	1906	392,770	10,139,751
1898	125,003	5,587,880	1907	382,915	9,432,575
1899	120,587	6,337,853	1908	283,470	8,078,583
1900	129,639	6,749,433			

The vessels using the entrance channel are steamers of 1,850 tons and less and sailing vessels of various kinds. The freight carried is principally lumber, naval stores, and general merchandise. There are three lines of steamships plying between Georgetown and northern ports. The water rate on lumber, the chief export, had decreased from $5.50 per thousand feet B. M. in 1892 to $4.12½ in 1905, but it has since advanced to $6.

For references to examinations and surveys see page 250, Annual Report of the Chief of Engineers for 1904.

July 1, 1908, balance unexpended	$48,339.81
Receipts, account of sales, etc	65.29
Amount allotted from appropriation by river and harbor act approved March 3, 1909	15,000.00
	63,405.10

June 30, 1909, amount expended during fiscal year:		
For works of improvement	$24,615.40	
For maintenance of improvement	24,381.38	
		$48,996.78
July 1, 1909, balance unexpended		14,408.32
July 1, 1909, outstanding liabilities		1,720.26
July 1, 1909, balance available		12,688.06
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		40,000.00

Report of a survey is printed in House Document No. 398, Fifty-eighth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, January 8, 1904.

SIR: I have the honor to submit herewith reports, dated April 8 and September 26, 1903, with map, by Capt. J. C. Sanford and Capt. G. P. Howell, Corps of Engineers, on preliminary examination and survey, respectively, of Georgetown Harbor, with a view of obtaining a channel with a navigable depth of 18 feet at mean low water, and a width of 400 feet, or such width as may be necessary or practicable, from a point 1 mile above the limits of the city of Georgetown, in Sampit River, to the ocean entrance to Winyah Bay, South Carolina, as far seaward as may be necessary to form a project to secure said depth. These reports are made in compliance with a requirement in the river and harbor act of June 13, 1902, and attention is invited to the views thereon by Lieut. Col. James B. Quinn, Corps of Engineers, division engineer.

This locality is now under improvement by the United States, with a view to providing a depth of 15 feet at mean low tide by means of jetties and dredging, and in the opinion of the district and division engineers the further improvement proposed is worthy of being undertaken by the General Government. Captain Howell discusses in his report plans for improvement by way of two routes, designated as the eastern channel and the western channel, respectively, but he prefers the route via the eastern channel because less expensive, and he presents a detailed estimate of the cost of providing an 18-foot channel, 400 feet wide, by dredging and jetty construction; but the selection of the eastern channel for improvement is not approved by the division engineer, who recommends that the western channel be improved, and that training dikes be constructed as proposed by him.

These reports have been reviewed by the Board of Engineers for Rivers and Harbors, under the provisions of sections 3 and 14 of the above-mentioned act, and reports thereon are made in indorsements of July 7 and December 22, 1903. The existing project for improvement is summarized in the Board's report of July 7, and the Board recommends in its report of December 22 that this project be modified so as to provide for an 18-foot channel, as proposed by the act, at an estimated cost of $650,000, inclusive of the balance of funds on hand, the improvement to be made by way of the western channel and to be accomplished by means of dredging and the construction of a training wall to deflect the current into the concave bend along the western shore.

I concur in the views of the Board.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers, U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

GREAT PEDEE RIVER, SOUTH CAROLINA.

The river in its original condition was dangerously obstructed by logs everywhere. Boats drawing 9 feet of water were able to reach Smiths Mills, 52 miles above the mouth. Those drawing 3½ feet

could get 54 miles farther up at low water to Little Bluff, or at high water to Cheraw, 167 miles from the mouth.

The project of improvement adopted in 1880 provides for a thoroughly cleared 9-foot navigation to Smiths Mills and a 3½-foot navigation to Cheraw at all stages of water.

The original project contained no estimate of cost. From 1880 to 1886, inclusive, $47,000 was appropriated. In the Annual Report of the Chief of Engineers for 1886, page 170, it was estimated that $70,000 in addition to this $47,000 would complete the improvement, and that $5,000 a year would be required for maintenance.

A project for the improvement of the upper river (the 64 miles between Cheraw and the bridge of the Wilmington, Columbia and Augusta Railroad) was adopted in 1902. (See Annual Report of the Chief of Engineers for 1901, p. 1607.) This project provides for obtaining, by snagging and dredging, a cleared channel, with a least depth of 3½ feet at mean low water, at a cost of $118,300; and the work was placed in the continuing-contract class. This total amount has been appropriated.

The total expenditures to June 30, 1909, were $256,873.48.

The river had been well cleared of snags from the mouth to the Wilmington, Columbia and Augusta Railroad bridge, 103 miles, and less thoroughly snagged between the bridge and Cheraw, 48,466 snags, etc., having been removed since June 30, 1884.

As nearly as could be determined by the records, about $78,919.13 had been expended in originally clearing the river of snags and in preliminary examination and survey made in 1900, $104,793.28 in dredging, and about $73,161.07 in maintenance.

The expenditures during the year were for operation of dredge and snag boats, for prosecuting the improvement, and for maintenance in the removal of 142,445 cubic yards of dredged material and 3,733 obstructions.

About 99 per cent of the approved project for the upper river has been completed up to June 30, 1909. The contemplated depth (3½ feet) has been attained on the upper portion of the river.

The appropriation recommended will be applied to redredging and snagging for maintenance of the improvement from the mouth of the river up to Cheraw.

At mean low water 8 feet can be carried to Smiths Mills, 52 miles above the mouth, and about 3½ feet to Cheraw, the head of navigation, 167 miles above the mouth.

The usual variation in water level is 16.4 feet at Smiths Mills and 34.2 feet at Cheraw.

Commercial statistics.

Year.	Tons.	Value.	Year.	Tons.	Value.
1891	62,344	$1,367,330	1900	154,727	$2,645,560
1892	92,471	1,401,088	1901	188,912	2,811,080
1893	94,661	1,166,874	1902	152,008	1,328,970
1894	91,025	1,169,070	1903	153,014	1,338,750
1895	106,115	898,480	1904	162,566	1,507,181
1896	229,961	1,325,250	1905	148,869	1,618,551
1897	114,177	1,167,914	1906	175,250	1,751,475
1898	75,280	1,228,885	1907	229,898	1,967,380
1899	134,072	1,692,709	1908	48,690	1,559,543

The vessels engaged in traffic on this river are steamers of 400 tons and less, seagoing schooners, pole boats, rafts, etc. No new line of transportation was established during the year.

One steamer which formerly ran to Cheraw was discontinued.

It has been found impossible to obtain information as to the effect of the improvement on freight rates.

July 1, 1908, balance unexpended		$42,387.62
Receipts, account of sales		19.96
Amount allotted from appropriation by river and harbor act approved March 3, 1909		10,000.00
		52,407.58
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$10,119.72	
For maintenance of improvement	23,841.38	
		33,961.10
July 1, 1909, balance unexpended		18,446.48
July 1, 1909, outstanding liabilities		1,119.57
July 1, 1909, balance available		17,326.91
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		30,000.00

Report on a recent survey of Great Pedee River is printed in House Document No. 1162, Sixtieth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 5, 1908.

SIR: I have the honor to submit herewith for transmission to Congress reports of April 18, 1907, by Capt. G. P. Howell, Corps of Engineers, and June 5, 1908, by Capt. E. R. Stuart, Corps of Engineers, on preliminary examination and survey, respectively, authorized by the river and harbor act approved March 2, 1907, of Great Pedee River, South Carolina, from Georgetown to Pedee Station.

As shown by these reports Great Pedee River has been under improvement by the United States for a number of years. The further improvement now proposed consists in securing a low-water navigable depth of 3½ feet over the section of the river under consideration, which conforms to the depth contemplated by the present project for work on the river above Pedee Station to the head of navigation at Cheraw. It is proposed to effect this improvement below Pedee Station by a small amount of dredging and by the construction of a snag boat and its operation for two years, in which time it is expected to complete the work. The estimate of cost of the operations now proposed is $53,000, with $5,000 annually for maintenance after completion.

I concur in the opinion of the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors that Great Pedee River from Georgetown to Pedee Station is worthy of further improvement to this extent.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

The Great Pedee River is navigable from its mouth in Winyah Bay, near Georgetown, to Cheraw, S. C., 167 miles. The improvement of the upper stretch of the river, from Cheraw to Pedee Station, a distance of 64 miles, was provided for in the river and harbor act of June 13, 1902. The adopted project provides for obtaining, by snag-

ging and dredging, a cleared channel with a least depth of 3½ feet at mean low water at a cost of $118,300. A combination snag and dredge boat has been constructed by the Government, and the work of providing the adopted channel is well under way.

The river has been under improvement for a number of years. In 1784 the State of South Carolina made an appropriation for this purpose, and additional appropriations were made later. In 1873 the United States Government assumed control of the improvement, and in 1879 a survey of the river below Cheraw was called for. As a result of this survey a project was formed in 1880 for a channel 9 feet deep at all stages as far as Smiths Mills, and thence a channel 3½ feet deep at all stages to Cheraw.

The portion of the river that is now under examination is from Pedee Station on the Atlantic Coast Line Railroad, 103 miles above the mouth, to the mouth in Winyah Bay, at the city of Georgetown, S. C.

An examination of the statistics submitted indicates that an annual commerce slightly in excess of 169,000 tons, with a value of about $1,200,000 will be directly affected by the proposed improvement.

LITTLE PEDEE RIVER.

The river in its original condition was much obstructed by snags and overhanging trees and by 10 bridges without draws. In places it was divided into several branches, in none of which was there a good channel.

Under the plan of improvement adopted in 1888 it is proposed to snag the river and close unnecessary branches, providing for steamboat navigation up to the mouth of Lumber River, 65 miles, and for pole-boat navigation 48 miles farther, to Little Rock, at an estimated cost of $50,000.

The total expenditures to June 30, 1909, were $25,074.01. The river had been well snagged up to the mouth of Lumber River and roughly cleared for pole-boat navigation to Little Rock. No work had been done toward increasing the original depths. As nearly as could be determined from the records, about $19,549.99 had been expended in originally snagging the river, and about $5,524.02 in maintenance. About 50 per cent of the project has been completed.

There were no operations during the year. Expenditures shown, $21, were for repairs to plant.

The aggregate number of obstructions removed since beginning of the improvement in 1888 is 31,718.

The appropriation recommended will be applied to snagging portions of the river as yet untouched and to work of maintenance.

The available depths now existing do not probably differ greatly from the original depths. No permanent improvement can be effected toward increasing the maximum draft over the shoals without considerable dredging, which was not provided for in the original project. The usual variation in water level at Gilchrist Bridge, about 65.5 miles above the mouth, is about 9.5 feet.

Commercial statistics.

Year.	Tons.	Value.	Year.	Tons.	Value.
1891	4,614	$52,760	1900	23,780	$173,500
1892	7,115	92,964	1901	51,460	399,000
1893	6,153	101,535	1902	57,050	416,000
1894	8,375	114,600	1903	77,750	560,500
1895	12,438	117,470	1904	83,100	645,000
1896	17,060	198,500	1905	87,985	663,650
1897	13,162	100,400	1906	18,880	389,500
1898	11,900	105,750	1907	14,513	243,250
1899	16,685	144,787	1908	11,992	97,290

Vessels ply on the river as far as Gallivant's bridge, 47 miles above its mouth; the river is probably navigable at its mean low-water stage for boats with 3-foot draft as far as Gallivant's bridge. The head of navigation is Little Rock, 113 miles above the mouth. No new line of transportation was established during the year.

The balance on hand will be spent in maintaining the channel.

A consolidated money statement for this river and the Waccamaw is submitted, a joint appropriation having been made.

July 1, 1908, balance unexpended		$4,138.70
Receipts, account of sales		20.01
Amount allotted from appropriation by river and harbor act approved March 3, 1909		4,000.00
		8,158.71
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$2,344.50	
For maintenance of improvement	21.00	
		2,365.50
July 1, 1909, balance unexpended		5,793.21
Amount (estimated) required for completion of existing project		52,100.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		44,000.00

MINGO CREEK, SOUTH CAROLINA.

To June 30, 1897, $17,000 had been expended on improvement to provide steamboat navigation up to Williams Landing and pole-boat navigation at high water up to the head of navigation by snagging and clearing the banks.

Deterioration having occurred, the sum of $300 was allotted from the emergency appropriation provided by the river and barbor act of March 2, 1907, of which $257.75 had been expended during the fiscal year 1908, for removing the worst obstructions to navigation.

No work was done during the past year. The small amount available was held for removing obstructions blocking or seriously interfering with navigation.

It is proposed to apply the appropriation recommended to snagging to maintain the channel.

July 1, 1908, balance unexpended	$42.25
July 1, 1909, balance unexpended	42.25
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	1,000.00

SANTEE, WATEREE, AND CONGAREE RIVERS, AND ESTHERVILLE-MINIM CREEK CANAL, SOUTH CAROLINA.

(*a*) *Santee River and Estherville-Minim Creek Canal.*—This river in its original condition was considerably obstructed at all stages of water by sunken logs and snags. Its bar entrance was narrow, crooked, and shifting, with only about 4 feet of water at low tide, and so situated as to be difficult and expensive to improve.

The original project, adopted in 1880, contemplated providing an outlet for the river into Winyah Bay by constructing a canal from the river through Mosquito Creek into the bay. On this project there was expended $99,750.

The present project, adopted in 1889, contemplates providing a more satisfactory outlet into the bay by cutting a canal 70 feet wide and 6 feet deep at mean low water from the Estherville plantation to Minim Creek and for snagging the entire river. The estimated cost is $350,000, not including the amount expended under the original project.

The total expenditures under the present project to June 30, 1909, were $241,902.26, of which about $57,316.52 was for maintenance; of this, $32.50 was derived from sales at auction, etc. All the expenditure during the year was for maintenance, and consisted of the removal of 34,024 cubic yards of material and 54 stumps and logs from the canal, widening and deepening same. The first cut of the canal had been made entirely through, and this had been widened through a portion of its length. From the Santee River proper 1,818 obstructions had been removed.

The approved project is about 84 per cent completed.

Except at the Winyah Bay end, where, on account of the softness of the banks, the width has been reduced to 40 feet, the canal is 50 feet wide and 6 feet deep. The mean rise of tide at the canal is about 3½ feet. The least available depth in Santee River is about 4 feet at low water. The usual variation in water level at the Atlantic Coast Line bridge, about 54½ miles above the mouth, is about 19 feet, and at its junction with the Wateree and Congaree rivers, 143 miles above the mouth, about 20 feet. The river is navigable its entire length.

During the year the construction of a suction dredge was completed, for which the appropriation for this stream bears a part of the cost. For this there was an expenditure of $4,217.67. For dredging in the canal $10,784.21 was expended.

The appropriation recommended will be applied to widening the Estherville-Minim Creek Canal and to removing obstructions from Santee River.

The additional work proposed is necessary to make the improvements available and for extending the benefits.

Commercial statistics.

Year.	Tons.	Value.	Year.	Tons.	Value.
1891	100,255	$2,743,000	1900	179,090	$2,622,200
1892	110,523	2,775,800	1901	204,375	1,809,000
1893	124,182	2,679,600	1902	215,600	1,882,500
1894	115,428	2,375,000	1903	220,900	1,840,000
1895	117,690	2,224,800	1904	242,800	1,662,500
1896	134,135	2,204,600	1905	329,350	1,485,000
1897	134,206	2,159,940	1906	427,300	1,830,000
1898	112,205	2,203,800	1907	474,750	1,735,000
1899	154,327	2,679,100	1908	70,590	1,172,169

The vessels using the river and canal are steamers of from 10 to 500 tons, small sailing craft, pole boats, rafts, etc.

Amount (estimated) required for completion of existing project..... $109,000

(*b*) *Wateree River.*—In its original condition this stream had a low-water depth of from 3 to 4 feet from its mouth, 67 miles, to Camden. The lower 14 miles was completely blocked at all stages of water by logs, snags, etc., and at moderate stages by the bridges of the South Carolina and the Wilmington, Columbia and Augusta railroads, then without draw spans; thence to Camden navigation was possible, but dangerous, except during high water. Its commerce was practically nothing.

The present project of improvement, adopted in 1881, provides for safe and unobstructed 4-foot navigation for steamers from Camden to the mouth, at an estimated cost of $60,000.

The appropriation of September 19, 1890, completed the estimate for the project, but appropriations have since been made for maintenance. The work is one of snagging and dredging, and as snags are continually lodging, it is not susceptible of completion. Snagging work should be done annually in order to keep the channel open.

The total expenditures to June 30, 1909, were $140,699.45. To June 30, 1900, the river had been kept fairly clear of obstructions from the mouth to Camden. Work was suspended in 1899, and was resumed in May, 1907, a snag boat having been built for this stream. All the expenditures during the year were for maintenance.

Snagging was done during the year and a total of 1,871 obstructions were removed.

Toward the construction of a suction dredge an expenditure of $4,100 was made under contract for machinery; for machinery for a snag boat there was expended $8,665.25 under contracts.

The appropriation recommended will be applied to snagging and dredging for maintenance of the improvement.

The additional work proposed is necessary to make the improvement available.

So far as known the available depths now existing do not differ greatly from the original depths. The usual variation in water level is about 17 feet at a point about 4 miles above the mouth, and about 28.5 feet at Camden, 67 miles above the mouth.

The river is navigable from the mouth to Camden.

Commercial statistics.

Year.	Tons.	Value.	Year.	Tons.	Value.
1891	1,005	$51,210	1900	93,024	$155,000
1892	2,244	86,040	1901	10,417	50,000
1893	6,242	117,729	1902	42,575	92,500
1894	18,075	94,334	1903	41,050	87,000
1895	21,697	127,565	1904	15,600	29,700
1896	35,002	233,525	1905	22,000	41,000
1897	43,770	202,800	1906	16,200	81,000
1898	83,568	274,050	1907	56,400	564,000
1899	109,170	272,200	1908	35,720	182,669

Rafting is the only business done on this river. No new line of transportation was established during the year.

(*c*) *Congaree River.*—In 1886 this stream in its original condition had a low-water depth of 3 to 4 feet from its mouth to the railroad bridge at Columbia, thence 1 foot low-water depth 2 miles farther to its head. The navigation of the lower 49 miles was blocked at all stages of water by the South Carolina Railroad bridge and by sunken logs, snags, and overhanging trees. The navigation of the remaining 2 miles was prevented by swift currents and numerous rock ledges and bowlders. Its commerce was nothing.

The project of improvement adopted in 1886 proposes to secure a thoroughly cleared 4-foot navigation over the lower 49 miles at all stages of water and a cleared channel through the rock ledges and bowlders above at an estimated cost of $54,500. This project was modified in 1899, when a lock and dam was authorized for extending steamboat navigation through these ledges and bowlders in the river from Gervais Street Bridge, Columbia, to Granby. The open-channel work above Granby was thus eliminated for the time being. Appropriations for the lock and dam were made, amounting to $250,000, $25,000 of which, by authority of Congress, was allotted for the open-channel work. The lock and dam had been completed with the $225,000, and considerable work done in clearing the channel between the lock and the city of Columbia.

The river and harbor act of March 2, 1907, contained the following proviso in appropriating for this stream: "And the limits of the improvement of the Congaree River shall be extended to include that part of the said river included in the project from Gervais Street Bridge, Columbia, to Granby, South Carolina." Under this authority the work on the entire length of the river will be prosecuted under allotments from appropriations for improving Santee, Wateree, and Congaree rivers and the Estherville-Minim Creek Canal, South Carolina.

In 1905 a survey of the river between the lock and dam and the mouth of the river, made to determine what additional work was required to form a 4-foot channel at all stages of water, showed that in addition to clearing the river of obstructions by snagging, dredging was also required, and that the estimated cost of the project should be increased accordingly. To obtain and maintain this channel would cost $20,000 a year for four years, after which a yearly expenditure of $10,000 would probably suffice.

The total expenditures for open-channel work to June 30, 1909, were $132,241.80. The channel had been thoroughly snagged from the mouth to Granby, 2 miles below Columbia. A total of 17,057 obstructions had been removed below Granby. Dredging had been carried on, removing 157,143 cubic yards of sand and pebbles. Work had been in progress of clearing the channel above the lock. As nearly as can be determined from the records about $70,855.14 has been applied to work of maintenance.

Snagging was done during the year and a total of 707 obstructions were removed. During the year approximately 730 tons of rock was removed. This rock excavation made it possible for steamers to land at the foot of Senate street, Columbia, S. C.

Under allotments from the emergency appropriation provided by the river and harbor act of March 2, 1907, made November 12, 1908 ($5,125), and February 17, 1909 ($1,800), derrick *A* was operated

forty-six days in removing snags, dragging channel, dredging stone from the rock cut, etc., to restore the channel depths above the lock; about 393 tons of stone were removed; the dredge *Congaree* removed from the channel 134,462 cubic yards of sand, and a 6-inch pump was operated eighteen days pumping sand from the channel. The expenditures from these allotments were $5,843.66, and were rendered necessary by the extraordinary flood in the Congaree River which occurred in August, 1908.

It is thought that to secure safe and certain navigation of the portion of the river above Granby it will be necessary to reconstruct the dam, so as to raise the pool level 2 feet, at an estimated cost of $50,000.

The appropriation recommended will be applied to work of improvement in removing bars and obstructions between the mouth and Columbia.

The usual variation in water level at a point 2 miles above the mouth is about 24.3 feet and at Columbia about 33.2 feet. Columbia is the head of navigation and is distant 51 miles from the mouth.

Commercial statistics.

Year.	Tons.	Value.	Year.	Tons.	Value.
1891	2,401	$47,840	1900	121,368	$197,000
1892	3,686	62,025	1901	14,583	70,000
1893	2,781	71,125	1902	58,075	123,500
1894	7,974	40,760	1903	114,310	271,400
1895	8,993	45,700	1904	43,035	98,900
1896	18,307	178,900	1905	34,350	252,000
1897	40,857	110,100	1906	35,522	821,100
1898	81,362	201,700	1907	78,833	1,284,000
1899	88,696	191,700	1908	22,122	506,994

A steamboat line between Columbia and Georgetown, S. C., has been established. Connection is made at Georgetown with steamers for New York, Baltimore, and Charleston. Boats are now landing at foot of Senate street, Columbia, S. C., the present head of navigation. A reduction of from 22 to 30 per cent in freight rates from Columbia to New York (difference between rail and water transportation) has been effected by the improvement.

CONSOLIDATED.

July 1, 1908, balance unexpended	$93,662.43
Receipts, account of sales	95.07
Amount allotted from appropriation by river and harbor act approved March 3, 1909	48,000.00
Allotted (emergency appropriation of March 2, 1907):	
November 12, 1908	5,125.00
February 17, 1909	1,800.00
	148,682.50
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	90,817.10
July 1, 1909, balance unexpended	57,865.40
July 1, 1909, outstanding liabilities	6,092.34

July 1, 1909, balance available	$51,773.06
July 1, 1909, amount covered by uncompleted contracts	1,005.97
Amount (estimated) required for completion of existing project	109,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	64,000.00

Following is the letter of the Chief of Engineers submitting report on a recent survey printed in House Document No. 608, Sixty-first Congress, second session:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, January 27, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated August 7, 1909, and January 18, 1910, by Capt. E. M. Adams, Corps of Engineers, on preliminary examination called for by the river and harbor act approved March 3, 1909, of Wateree, Congaree, and Santee rivers, including the Estherville-Minim Creek Canal, South Carolina, and upon the proposed modification of movable dam at Granby, Congaree River, respectively.

This river system, Wateree, Congaree, and Santee rivers and Estherville-Minim Creek Canal, is under improvement by the United States under projects providing for 4-foot navigation from Camden on the Wateree and Columbia on the Congaree to the Santee River, down which river to the canal over 4 feet has always been available, and for 6-foot depth through the canal to Winyah Bay. In the opinion of the district officer these streams are not worthy of a more extensive improvement than that contemplated by existing projects, and this opinion is concurred in by the division engineer and the Board of Engineers for Rivers and Harbors.

The district officer states, however, that the best way to secure and maintain the project depth above Granby dam in the Congaree River is to raise the dam 2 feet, and he presents a plan for this work at an estimated cost of $55,982.

In the opinion of the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors, this locality is worthy of improvement by the General Government to the extent indicated. These views are concurred in by me.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

WATERWAYS BETWEEN CHARLESTON AND ALLIGATOR CREEK, SOUTH CAROLINA.

These waterways consist of a series of creeks, sounds, rivers, and bays, which afford a route sheltered for the most part from the sea by the numerous islands which form the outer coast line. The route is tidal throughout, the range of tide varying from about 4.6 to 5.3 feet. It is now obstructed by a number of shallow reaches and narrow, crooked passages, particularly at points where the tides meet. The passage across Bulls Bay, besides being very shallow, is much exposed. The present commerce is comparatively small, as only very small vessels can get through without excessive delays.

The plan of improvement adopted in 1902 provides for a channel between Charleston Harbor and opposite McClellanville 4 feet deep at mean low water and 60 feet bottom width, at an estimated cost of $125,290. The project was modified by the river and harbor act of March 2, 1907, to provide for a branch of the channel to Morrisons Landing in McClellanville. The new channel will partly follow the present channels and will partly lie in cuts across the marsh to avoid crooked and dangerous sections. It will pass to the northward of

Bulls Bay. A revised estimate made during the fiscal year 1908, based upon work already done, shows that to complete the improvement there will be required $66,000 in addition to the amount originally estimated.

The total expenditures to June 30, 1909, were $122,052.01. A contract was let in 1905, under which there was removed 158,441 cubic yards; a second contract was made during the present fiscal year for continuing the work, and under this there has been removed 297,264 cubic yards, making a total of 455,705 cubic yards, which is about 64 per cent of the approved project.

The appropriation recommended will be applied to prosecution of the improvement by dredging between Grahams Creek and McClellanville.

The improvement can have no effect on freight rates until the project shall have been completed.

Commercial statistics.

Year.	Tons.	Value.	Year.	Tons.	Value.
1903	33,344	$579,520	1906	49,440	$797,747
1904	39,064	573,770	1907	36,230	921,675
1905	58,421	608,761	1908	32,388	1,146,240

July 1, 1908, balance unexpended	$47,805.28
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	52,805.28
June 30, 1909, amount expended during fiscal year, for works of improvement	44,567.29
July 1, 1909, balance unexpended	8,237.99
Amount (estimated) required for completion of existing project	66,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	66,000.00

BRUNSWICK HARBOR, GEORGIA.

Previous to June 13, 1902, the appropriations for the improvement under the Engineer Department were for the inner harbor only, consisting principally of the removal of a shoal in East River, opposite the lower part of the city. The act of Congress approved June 13, 1902, provided also for the improvement of the bar, which work had theretofore been caried on by direct contract between Congress and a private individual, at a cost of $270,000.

The harbor is navigable from the city of Brunswick to deep water beyond the bar, a distance of 13 miles, and also for 1 mile up Academy Creek, and up Turtle River to the Southern Railway wharves.

The original project of improvement, dated April 29, 1876, provided for the construction of a jetty at the city front and dredging, at a total cost of $69,000.

Under this project and its modifications there was expended, prior to operations under the existing project, the sum of $190,000.

The project in force up to June 13, 1902, was adopted by Congress in 1894. It provided for the maintenance of a navigable channel 15 feet deep at mean low water by keeping the existing works in repair and by dredging. The act of June 3, 1896, provided for the improvement of Academy Creek. The cost of maintaining a channel depth of 15 feet at mean low water was estimated at $15,000 per annum.

There had been expended under this project up to June 30, 1902, $34,817.25, all of which had been for maintenance.

Including $10,000 spent in 1836 for dredging, the total amount expended up to June 30, 1902, on the inner harbor was $234.817.25.

The act of Congress approved June 13, 1902, adopted a project providing for a navigable channel 21 feet deep at mean low water in Brunswick inner harbor, at a cost of $120,000, and for a channel across the outer bar 19.3 feet deep at mean low water (26 feet at mean high water), at a cost of $40,000. It also provided for dredging in Academy Creek at not to exceed $5,000. This project was completed in July, 1905, and expenditures since have been for maintenance.

The river and harbor act of March 3, 1905, authorized the expenditure from the amount therein appropriated of $5.000, or so much thereof as might be necessary, for maintaining in Academy Creek, immediately in front of and adjacent to the wharves thereof, to the Old Altamaha Canal a depth equal to the controlling depth on the shoals at the lower end of the city in East River, provided that no money should be expended inside harbor lines theretofore or thereafter established in said creek. With these funds a channel was dredged with a depth of 18.5 feet at mean low water and a width ranging from 50 to 90 feet.

The amount expended to June 30, 1907. under the project approved June 13, 1902, was $193,062, of which $19,596.82 was for maintenance. This, added to the amounts previously expended, gives a total expenditure for the work up to June 30, 1907, of $697,879.25.

The result of this expenditure has been the accomplishment of a navigable channel throughout the inner harbor 21 feet deep at mean low water and of a channel across the outer bar 19.3 feet deep at mean low water (both 26 feet at mean high water); also of a narrow channel in Academy Creek above mentioned.

A new project was adopted by the act of Congress approved March 2, 1907. This project will be found printed as House Document No. 407, Fifty-ninth Congress, first session. It provides for creating and maintaining throughout the inner harbor (embracing Turtle River from the Southern Railway docks to its junction with Brunswick River, Academy Creek from Aiken's wharf to its junction with East River) and the outer harbor (embracing the outer bar, the navigable channel throughout the entrance to St. Simons Sound, and up Brunswick River to Brunswick Point) channels having a depth of 30 feet at mean high water, with widths varying from 150 feet in Academy Creek to 400 feet across the outer bar, to be accomplished mainly by dredging; but the extension of the existing training wall in East River and the construction of two spur dikes is also authorized. The estimated cost of the work is $496,650, with a yearly cost of maintenance not exceeding $33,250.

Congress in adopting this project appropriated the sum of $146,650 for the work and authorized contracts covering labor and materials

necessary for its completion at a cost not to exceed $350,000 additional, all of which has been appropriated.

The amount expended under the present project up to June 30, 1909, was $369,245.25, and resulted in the dredging of a channel in East River, opposite the city of Brunswick, about 8,500 feet in length, 350 feet in width, and 30 feet in depth at mean high water, except for two small areas on the extreme eastern edge of the channel composed of refractory material and which was not required to be removed under the contract in force; the dredging of a channel about 4,700 feet in length, 150 feet in width, and 30 feet in depth at mean high water, in Academy Creek; the dredging of a channel in Turtle River, opposite Buzzards Island, about 3,500 feet in length, 300 feet in width, and 30 feet in depth at mean high water, except at one point on the upper shoal where refractory material was encountered; the removal of 124,420.9 cubic yards of material from the shoal opposite Brunswick Point, and the removal of 1,170,066.5 cubic yards from the channel across the outer bar.

During the fiscal year dredging operations were continued under two contracts and resulted in the removal of 349,160.1 cubic yards of material from the inner harbor, 114,267.5 cubic yards from the shoal opposite Brunswick Point, and 713,211 cubic yards from the channel across the outer bar.

Work was in progress at the close of the fiscal year, and the allotment will suffice to complete the project.

The total amount expended for the improvement of Brunswick Harbor up to June 30, 1909, was $1,067,124.50.

The proportion of the present project accomplished to June 30, 1909, was 85 per cent for the outer bar, 75 per cent for the shoal opposite Brunswick Point, and 90 per cent for the inner harbor.

The controlling depth on the bar, from the basin inside to the bell buoy, a distance of about 3 miles, is 30 feet at mean high water. From the bell buoy to deep sea outside, a distance of about 1 mile, the controlling depth is 28 feet at mean high water, and dredging over this portion is now in progress. At Brunswick Point the controlling depth is 28 feet at mean high water, and dredging over this portion is now in progress; in East River, 30 feet; in Turtle River, upper shoal, 27 feet, lower shoal, north of center range, 29 feet, and on center range and to the south of same, 24.5 feet. The general depth in East River and Turtle River is 30 feet, and these lesser depths are simply a few high points of refractory material for the removal of which a new contract will be made, funds being available for the purpose. In Academy Creek, owing to rapid shoaling since the completion of dredging, there is now at the entrance a narrow channel on one side of the shoal with a depth of 26.5 feet, and upon the other side of the entrance a similar channel with only 22 feet; elsewhere the controlling depth is 30 feet at mean high water.

The mean rise and fall of tide on the bar is 6.6 feet, at Brunswick Point 7 feet, and at the city of Brunswick 7.1 feet.

It is proposed to apply the available balance and additional appropriation recommended in carrying out the approved project and maintaining the improvement. The additional work proposed is for extension of benefits.

Before improvement in 1880 the annual commerce of Brunswick Harbor amounted to about 100,000 tons, valued at $1,700,000. The total commerce of the port for the calendar year 1908 amounted to 1,200,000 tons of freight, valued at $39,892,165. The commerce consists principally of cotton, lumber, cross-ties, naval stores, and general merchandise.

The effect of the improvement has been to cause a reduction of ocean-going freight rates on lumber of 25 per cent and on naval stores of 30 per cent. It has also permitted the regular line coastwise freight steamers to enter and leave the port regardless of the tides, thereby avoiding much loss of time.

A list of the Annual Reports of the Chief of Engineers and of documents containing the various projects, maps, history of the work, etc., may be found printed on page 284 of the Annual Report of the Chief of Engineers for 1905.

Reference to report on survey of Brunswick Harbor, inner and outer, provided for by the river and harbor act of March 3, 1905, will be found on page 312 of Annual Report of the Chief of Engineers for 1906.

Pursuant to a requirement in the river and harbor act of March 2, 1907, an investigation has been made relative to the control and use of wharfage privileges at Brunswick Harbor, and report thereon was duly transmitted to Congress and printed in House Document No. 326, Sixtieth Congress, first session.

July 1, 1908, balance unexpended	$352,693.00
Amount appropriated by sundry civil act approved March 4, 1909	47,000.00
	399,693.00
June 30, 1909, amount expended during fiscal year, for works of improvement	260,167.50
July 1, 1909, balance unexpended	139,525.50
July 1, 1909, outstanding liabilities	30,238.40
July 1, 1909, balance available	109,287.10
July 1, 1909, amount covered by uncompleted contracts	43,044.85
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	50,000.00

HARBOR AT DARIEN, GA.

This harbor is navigable from its mouth to the town of Darien, a distance of 13 miles.

In its original condition it was obstructed at seven points by shoals, with mean low-water depths of from 6½ to 10½ feet. Between the shoals there was nowhere less than 12 feet at mean low water.

There was expended on this harbor in 1879 for dredging $8,000, without any project having been recommended or adopted.

The project for the improvement of this harbor, adopted in 1885, contemplates the establishment of a navigable channel 12 feet deep at mean low water between Darien and Doboy, at an estimated cost of $170,000. Work was not begun under this project until 1891. The total amount expended under it up to June 30, 1909, was $157,365.96

(of which $20,572.75 was for maintenance), which, added to the amount previously expended, gives a total for this work of $165,365.96. The work done under the present project has resulted in a navigable channel 12 feet deep at mean low water from Darien to Doboy. The project was reported as completed July 11, 1905.

No work was done during the fiscal year, no funds being available.

On June 30, 1909, the controlling depth in the harbor was 10 feet at mean low water, shoaling having occurred at several places since the project depth of 12 feet was obtained in July, 1905. The mean rise and fall of tide is from 6.5 feet at Darien to 7 feet at the entrance.

The additional work proposed is for maintenance only.

The total tonnage for 1878 was estimated at about 200,000 and the value of exports at between $600,000 and $700,000. The commerce consists almost entirely of timber, and in 1908 the total shipments amounted to 33,856,228 feet, valued at $501,312. In addition there was 55,485,000 feet rafted through the harbor to Sapelo and to Savannah. The local freight handled at the port during 1908 amounted to 3,000 tons, valued at $180,000.

The improvement of this harbor has rendered it possible to ship lumber from Darien, which before was impracticable, and has caused a reduction in freight rates of about 15 per cent.

By act of Congress approved June 13, 1902, this work was consolidated with Doboy bar, Georgia.

Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement..... $10,000.00

SAPELO BAR AND HARBOR, GEORGIA.

Report on a recent survey is printed in House Document No. 561, Sixty-first Congress, second session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., November 22, 1909.

Respectfully returned to the Chief of Engineers, U. S. Army.

The results of the preliminary examination of Sapelo bar and harbor indicated that the depth of water and general condition of the channel over the bar were satisfactory, but that some improvement of the harbor (Front River) was desirable. A survey of the inner harbor was recommended, and interested parties were notified of the adverse report as to the bar and invited to submit statements and arguments in reference thereto. No communications have been received, and the Board has formed the opinion, in concurrence with the views of the district officer, that improvement on the bar is inadvisable.

The survey develops three obstructing shoals in the inner harbor which the district officer believes should be removed at a cost, estimated by him, of $50,000. It appears that the greater part of the business of the locality is carried on below the upper shoal, that the cost of removing this shoal would be nearly 60 per cent of the total estimate, and that ample facilities would be afforded for handling all the commerce of the harbor if the two lower shoals were removed. The cost of such an improvement is estimated in the appended report at $21,000, which amount appears to bear a just relation to the commercial importance of the harbor. It seems impracticable to estimate the probable cost of maintenance, but it is believed from the information now available that this item will not be excessive.

In view of these facts, the Board reports that in its opinion Sapelo Harbor (Front River) is worthy of improvement to the extent of removing the two lower shoals at an estimated cost of $21,000, with such amount for maintenance, not exceeding $1,750 annually, as experience may determine necessary.

In compliance with the provisions of section 13 of the act of March 3, 1909, the Board further reports that neither the establishment of terminal facilities, the development and utilization of water power for industrial and commercial purposes, nor any other subjects not considered within are so related to the project for improvement of navigation at this locality as to be coordinated in a logical and proper manner with such project to lessen the cost thereof and to compensate the Government for expenditures made in the interest of navigation.

For the Board:

JOHN G. D. KNIGHT,
Colonel, Corps of Engineers,
Senior Member of the Board.

The following is from the report of the local engineer:

Sapelo bar lies about 13 miles north of Doboy bar. Sapelo Sound lies about 27 miles from Darien, Ga., while Doboy Sound is but 12 miles from this port. An improvement of Doboy bar was undertaken by the Government in 1905, but this was abandoned in 1906, and practically no benefit was derived from the work done. The mean high-water depth on Doboy bar is but about 17 feet, while on Sapelo bar the controlling depth is about 23 feet at high water. The great advantage of Sapelo bar over Doboy bar is as to depth, which permits reasonably heavy-draft vessels and steamers to enter Sapelo Sound, and landings have been constructed on Front River, which enters this sound, where steamers and vessels dock and receive cargoes of lumber and timber rafted or barged from Darien, and to a slight extent from other places.

The entire commerce of Sapelo consists of foreign shipments of lumber, amounting annually to about 50,000,000 superficial feet, valued at $750,000. No imports are brought in. The lumber is carried on bottoms with draft varying from 19 to 23 feet. All of this lumber has to be towed in rafts or barged for 27 miles to the protected waterway where the wharves are constructed. This protected waterway, locally called Front River, has a shoal at its mouth and two shoals in front and between the wharves, with a controlling depth upon the same of between 18 and 20 feet at mean high water. On account of these shoals vessels and steamers are frequently obliged to go down into the sound and anchor and there receive the remainder of their cargoes. In case of bad weather rafts can not be safely towed to the steamers, and heavy demurrage charges frequently result from the delays in shipments. The shippers estimate that there will be a saving of from six to ten thousand dollars annually if there was the same depth of water on these shoals as exists upon the bar.

SAVANNAH HARBOR, GEORGIA.

This covers the estuary of the Savannah River from the upper limits of the city of Savannah to the ocean bar, a distance of 26 miles, measured along the channel. In 1873 the channel was in places not more than 9 feet deep at mean low water.

The first appropriation for the improvement of this harbor was made in 1826, and had reference to the removal of natural and artificial obstructions, but the first comprehensive plan of improvement is dated February 11, 1853. Another, for the removal of obstructions, is dated about 1871.

A later plan of improvement is dated August 28, 1873, and was supplemented March 19, 1879. It contemplated the establishment of a channel from the city to the sea, practicable at high tide for vessels drawing 22 feet of water. This project was replaced by an enlarged one (January 16, 1882, Annual Report of the Chief of Engineers for 1882, Appendix J 4) contemplating the same channel depth. The amount expended under these projects up to June 30, 1890, was $1,850,528.53.

The project in force up to June 13, 1902, adopted in 1890, providing for a mean high-water depth of 26 feet from the city to the sea, is printed as part of Appendix O, Annual Report of the Chief of

Engineers for 1890. The channel depth contemplated by it was reported as having been obtained at the end of the fiscal year 1896. While the project depth was literally obtained, the channel was very crooked and of much less than the project width.

A supplemental plan of improvement was submitted December 7, 1894, providing for a detached extension of the Oyster Bed training wall, for the purpose of sheltering the anchorage in Tybee Roads, as well as for protecting the ship channel over the outer part of Tybee Knoll against the destructive action of heavy storms. This project, which is printed as part of Appendix M 1 of the Annual Report of the Chief of Engineers for 1895, was authorized by act of Congress of June 3, 1896, its estimated cost being $992,250. This work was never finished, the contract having beeen annulled in 1899, when less than one-third of the proposed work was accomplished. The same act authorized the completion of work for improving the inside route from Savannah, Ga., to Beaufort, S. C., at an additional cost of $106,700, and dredging for maintenance in Savannah Harbor, and the sum of $1,005,000 was appropriated to complete these works.

The amount expended under the project of 1890 up to June 30, 1896, was $3,460,049.99, of which $974,504.88 was for dredging and $2,356,720.10 for contraction work. There had previously been expended $1,850,528.53, giving a total of $5,310,578.52. Between June 30, 1896, and June 30, 1902, $712,918.84 was expended on the modified 26-foot project, of which $84,850.98 was for maintenance.

From the time of the reported completion of the project of 1890, in July, 1896, until June 30, 1902, extensive dredging was done, both for maintenance and as part of the modification of the project.

On June 13, 1902, Congress adopted a project which provided for the establishment of a channel from the Old Waterworks (2 miles above Savannah) to the ocean, 28 feet deep at mean high water, with bottom widths of 350 to 500 feet, to be accomplished by dredging and the raising of all existing training walls between Savannah and Tybee Roads. It also provided for the construction of mooring dolphins at two points in the harbor—the "Bight" and Venus Point. The estimated cost of the work was originally $1,567,791. This amount was increased by $210,000 by the act of Congress approved March 3, 1905. This project will be found printed in House Document No. 123, Fifty-sixth Congress, second session, and also in the Annual Report of the Chief of Engineers for 1901, page 1723.

The river and harbor act of March 3, 1905, called for a resurvey of Savannah Harbor, Georgia, with plans and estimates of cost, with a view to securing a channel to the sea 26 feet deep at mean low water. The survey was made and the plans and estimates prepared, and will be found printed as House Document No. 181, Fifty-ninth Congress, first session. This project was not adopted by Congress in its entirety, but the river and harbor act of March 2, 1907, appropriated $300,000, and in addition authorized continuing contracts in the sum of $700,000 (all of which has now been appropriated) for prosecuting the improvement and for maintenance, in accordance with the plans of the Board of Engineers for Rivers and Harbors, as set forth in the House document just referred to. The recommendation of the Board was that the improvement should be undertaken in a tentative manner, with the object of first securing across the bar the

maximum depth within the limits fixed by Congress that can be maintained by dredging alone, a 21-foot channel first to be dredged and then gradually deepened until the limit fixed by economy of maintenance is reached. The act authorized such raising and extending of dikes, jetties, and other contraction works as may be necessary at a cost not to exceed $300,000, and the purchase of a pumping dredge of the stationary type at a cost of $125,000. The increased depth gained upon the bar is to be carried up the river by dredging at such a rate as will insure the same navigable depth as is maintained on the bar.

The amount expended under the 28-foot project (mean high water) up to June 30, 1908, was $1,643,282.29, of which $214,043.28 was for maintenance. The sum of $672.25 was derived from sales of government property and deposited to the credit of the appropriation.

The expenditures to June 30, 1909, under the tentative project adopted March 2, 1907, amounted to $633,404.34, of which $124,103 was for maintenance, and $119,676.21 was disbursed by Maj. J. C. Sanford and Maj. Herbert Deakyne, Corps of Engineers, on account of the construction of the dredge provided for by the project. The sum of $8 was received from the sale of blueprints of the plans of the dredge, and $94.28 from sales of condemned property. The total amount expended for the improvement of Savannah Harbor up to June 30, 1909, was $8,300,183.99. A total of $1,075.94 was received from sales of condemned property and of blueprints. The sum of $500 was deposited to the credit of the appropriation by the clerk of the United States circuit court for the southern district of Georgia. The expenditure of this sum has secured and maintained the various objects had in view in projects heretofore stated, and with the net result of securing a navigable channel not less than 22 feet deep at mean low water from the wharves of Savannah to Tybee Roads, and not less than 24 feet thence to the sea.

The mean rise and fall of the tide on the outer bar is 7 feet; on Tybee Knoll, 6.8 feet; and at the upper limit of the harbor, 6.4 feet.

During the fiscal year the three United States dredges removed a total of 1,048,846 cubic yards of material for the advancement of the project. Of this, about 110,000 cubic yards was upon the ocean bar, 707,000 cubic yards in the roads, 61,000 cubic yards on the Knoll, and 171,000 cubic yards on the middle ground near the quarantine station. Ten thousand one hundred and forty-one and forty-four one-hundredths tons of rock and 912.15 cubic yards of brush fascines were used by D. Power & Co. in completing their contract for raising dikes and training walls, and 14,969.74 tons of rock were used by Roderick G. Ross in his contract for raising and strengthening the North Long Island and Cockspur Island training walls. Work under this last-named contract is still in progress. The Simons-Mayrant Company completed their contract for reopening the Screvens Ferry route by dredging, at a total cost of $2,574.40. They also completed supplementary contract for dredging in Mud River Cut, where 5,624 cubic yards of material were removed. These things, i. e., the work at Screvens Ferry and Mud River Cut, form no part of the improvement of Savannah Harbor, but were rendered necessary in consequence of regulating works built in the harbor.

In addition to the above, the United States dredges removed 691,203 cubic yards of material from the river above quarantine station, depositing the same at Venus Point, from whence about 380,000 cubic yards had been pumped ashore at the close of the year. The remainder is still to be rehandled. This last dredging was primarily for the purpose of maintenance and was the only maintenance work that was done during the year, but it was found, by comparing the present condition in the river with that of three years previous, that a substantial advance has been made toward the 26-foot project (mean low water). As careful an adjustment as can be made between the two indicates that $57,591 worth of work has been done for maintenance during the year.

All of the money authorized for the tentative project has been appropriated, but it is not yet all expended. It will be, however, by the 30th of June, 1910.

Briefly, the results indicate very clearly that a channel 26 feet deep at mean low water can be readily secured, at a cost within the estimate, across Tybee bar and through the roads, and also that it can be mintained at very moderate expense, and that the 26-foot depth can be carried up the river to the upper limit of the city at a cost within the estimate given in the 1905 project. In short, that the project can be carried out within the original estimate and that it gives every promise of being reasonably permanent and easily maintained. It is estimated that it will cost $1,545,000, in addition to funds now available, to complete the project. It is recommended that the project be adopted with a view to its completion by the 30th of June, 1914, the appropriation to be made in four annual installments, the first three of $400,000 each and the last in an amount sufficient to make up the balance.

It is proposed to expend the balance on hand and the additional appropriation recommended in maintaining and carrying forward, as authorized, the general project of 1905, printed as House Document No. 181, Fifty-ninth Congress, first session, with only such slight modifications as to the extent of dikes and training walls to be raised and strengthened as experience may indicate to be desirable and necessary. The additional work proposed is for extension of benefits.

The estimate submitted for the fiscal year 1911 is for maintenance only, leaving it for Congress to decide to what extent it proposes to further prosecute the work of improvement at this locality.

In 1872 the tonnage of vessels arriving and clearing at Savannah Harbor was reported to be somewhat more than 1,000,000 and the total value of imports and exports about $34,000,000. In 1890 the total tonnage was reported to have increased about 2,000,000 and the value of imports and exports to $152,000,000. For the calendar year 1908 the total amount of freight received and shipped at the port was 3,899,361 tons, valued at $167,941,267. The commerce consists principally of naval stores, fertilizers, produce, iron, cotton, lumber, and general merchandise.

The effect of the improvement upon freight rates since 1896 has been a reduction of from 30 to 50 per cent, according to the nature of the commodity.

A list of Reports of the Chief of Engineers and executive documents, in which the various projects, examinations, surveys, maps,

etc., are printed, may be found on page 272 of the Annual Report of the Chief of Engineers for 1905. A map of the harbor, showing conditions on June 30, 1906, will be found in the Annual Report of the Chief of Engineers for 1906, opposite page 1192.

Reference to report on resurvey of the harbor required by the river and harbor act of March 3, 1905, will be found on page 311 of the Annual Report of the Chief of Engineers for 1906.

July 1, 1908, balance unexpended		$376,051.89
Amount received from sales of government property		57.38
Amount appropriated by sundry civil act approved March 4, 1909		400,000.00
		776,109.27
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$248,562.74	
For maintenance of improvement	57,591.00	
		306,153.74
July 1, 1909, balance unexpended		469,955.53
July 1, 1909, outstanding liabilities		44,473.30
July 1, 1909, balance available		425,482.23
July 1, 1909, amount covered by uncompleted contracts		62,162.64
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		200,000.00

ALTAMAHA, OCONEE, AND OCMULGEE RIVERS, GEORGIA.

These three improvements were consolidated by the river and harbor act of March 2, 1907.

(*a*) *Altamaha River, Georgia.*—This river is formed by the junction of the Oconee and Ocmulgee rivers. At a point some 25 miles from its mouth the river branches, and the river traffic reaches the ocean by two routes—one by the north branch by way of Darien, and the other by the south branch to where it intercepts the inside waterway, which passage is taken to Brunswick.

Before improvement the Altamaha River was obstructed by rock ledges, sand bars, snags, sunken logs, and overhanging trees. The low-water depths at some points did not exceed 1 foot.

The original project of improvement, submitted in 1875, contemplated a channel 4 feet deep and 80 feet wide from Macon to Darien by the removal of sand bars, rock shoals, snags, overhanging trees, etc., at a cost of $162,000.

Under it and its modifications there was expended up to June 30, 1890, $64,776.59.

The existing project of improvement, adopted by Congress in 1890, provides for the establishment of a channel 3 feet deep at summer low water throughout the river above Darien. This is to be accomplished by removing rock shoals and sand bars, building deflecting dikes, and closing incipient cut-offs, removing snags and sunken logs from the channel and overhanging trees from the banks of the stream, and revetting caving banks. The total estimated cost of the improvement is $129,000, provided funds are regularly and adequately supplied, besides from $3,000 to $5,000 for annual maintenance.

The amount expended on the work under the present project up to June 30, 1909, was $94,059.68 (of which $17,188.64 was for maintenance), which, added to the amount previously expended, gives a total expenditure for this work of $158,836.27.

A total of $111.50 has been received from proceeds of sales of unserviceable property and deposited to the credit of the appropriation.

This expenditure has resulted in the removal of two rock shoals, six sand bars, numerous snags, sunken logs, stumps, and overhanging trees, and the straightening of the river at several points by cut-offs.

The river is navigable from the forks to Darien, a distance of 131 miles, and to where it reaches the inside waterway. The lower section of the river is affected by the tides. The worst shoal is at Coupers bar, which at low water has only about 3 feet of water, but by waiting on tides 5 feet can be had at this place. The controlling depth above the tidal range is about 2½ feet at summer low water. The river is subject to freshets, and in the upper sections the freshet height at times goes 20 feet above the low summer stage. The lower section is bordered by low swamp lands, and the freshets rise from 5 to 10 feet over the banks.

The work done during the year for maintenance consisted of the removal of 209 snags and 10 stumps and the cutting of 406 overhanging trees. Work for improvement consisted of the completion of a training wall at Oglethorpe Bluff and the removal of a false point at Buggs Suck.

The proportion of the approved project accomplished up to June 30, 1909, was about 80 per cent.

It is proposed to apply the available balance and the additional appropriation recommended in removing snags, stumps, and overhanging trees, in removing sand bars and rock shoals, and in repairing old works of improvement.

The additional work proposed is for extension of benefits.

The commerce of the river before the improvement was begun was reported to have amounted to about 100,000 tons annually, valued at about $1,000,000. During the calendar year 1908 it amounted to 13,700 tons, valued at $1,110,000. There was also rafted down the river during the same period 45,855,000 feet b. m. of timber, valued at $614,950.

As nearly as can be determined, the effect of the improvement has been to cause a reduction of from 25 to 40 per cent in freight rates.

Amount (estimated) required for completion of existing project..... $94,160

(*b*) *Oconee River, Georgia.*—The head of navigation on this river is Milledgeville, Ga., 147 miles from the mouth, though at present this point can only be reached during high stages of the river.

The river is navigable also for a distance of 17 miles between the Georgia Railroad bridge (54 miles above Milledgeville) and the northern boundary of Greene County. Between Milledgeville and the Georgia Railroad bridge, above, the river is obstructed by obstacles, both natural and artificial, and is incapable of improvement except by an expensive system of locks and dams. At ordinary stages the river is at present only navigable to a point about 25 miles above Dublin, Ga., a distance of 104 miles from its mouth. In its original condition this river was used principally for navigation at high stages. At low water there were numerous shoals and snags,

there probably being less than 2 feet on many sand bars and rock ledges.

The original project was submitted January 29, 1875, and provided for the removal of snags, overhanging trees, etc., cutting off points, and making cut-offs, at a cost of $10,150.

Under this project and its modifications there was expended, previous to the commencement of operations under the existing project, the sum of $44,822.18.

The existing project of improvement was adopted by Congress September 19, 1890. It provides for the establishment of a navigable channel 3 feet deep at ordinary summer low water from Milledgeville to the mouth. This is to be accomplished by removing rock shoals and sand bars, revetting caving banks, and closing incipient cut-offs, removing snags and logs from the channel and overhanging trees from the banks of the stream. The cost of improvement is estimated at $171,000, besides from $3,000 to $5,000 for annual maintenance. The river and harbor act of March 3, 1905, authorized the expenditure of $3,000 of the amount appropriated to be applied to cleaning out the river from the Georgia Railroad bridge to the northern boundary of Greene County, Ga., thus bringing this short section under improvement.

The amount expended under the present project up to June 30, 1909, was $150,421.27 (of which $15,944.47 was for maintenance), which, added to the amount previously expended, gives a total expenditure for this work of $195,243.45.

A total of $648.77 has been received from sales of unserviceable property, which was deposited to the credit of the appropriation.

As a result of this expenditure numerous snags and logs, bowlders, and overhanging trees have been removed, several cut-offs opened and others closed, six training dikes and one spur dam and 800 linear feet of shore protection built, and five rock shoals and several sand shoals removed below Milledgeville. Between the Georgia Railroad bridge, above Milledgeville, and the northern boundary of Greene County the most troublesome obstructions have been removed from the channel and numerous overhanging trees and logs cut on the banks.

Work done during the fiscal year for maintenance consisted of the removal of 3,278 snags and 3 stumps from the channel and the cutting of 8,010 overhanging trees and girdling of 49 large trees on the banks.

For improvement, 100 cubic yards of rock were removed from the channel at Devils Elbow and 450 cubic yards of earth dredged from the shoal at Steamboat bight; shore protection and a training dike were constructed at Fish Trap shoals and 350 cubic yards of stone quarried for use in proposed dike work.

On June 30, 1909, the controlling depth at ordinary summer low water between the forks and Dublin was about 3 feet, though the channel is very crooked and too narrow for easy navigation. Between Dublin and the Central of Georgia Railway bridge, 25 miles above, the controlling depth was 2.5 feet, and between the latter point and Milledgeville, 2 feet. From the Georgia Railroad bridge, above Milledgeville, to the northern boundary of Greene County, the controlling depth was 2.5 feet. This river occasionally falls below these depths and frequently rises to 20 feet above them.

The proportion of the approved project accomplished up to June 30, 1909, was about 85 per cent.

It is proposed to apply the available balance and additional appropriation recommended toward the removal of snags and stumps from the channel and the cutting of overhanging trees from the forks to Milledgeville; the removal of rock and sand shoals between the forks and the Central of Georgia Railway bridge, 25 miles above Dublin; in making repairs to existing dikes and protecting caving banks; and in closing incipient cut-offs and opening others wherever found advisable.

The additional work proposed is for extension of benefits between the forks and Milledgeville. No additional work above Milledgeville is proposed.

No reliable statistics of the commerce of the river before the improvement was begun are available. During the calendar year 1908 the amount of freight carried on the river between the forks and Milledgeville amounted to 19,000 tons, valued at $247,000. There was also rafted on this portion of the river during 1908, 17,390,000 feet b. m. of timber, valued at $258,000.

As nearly as can be determined the effect of the improvement has been to cause a reduction of from 25 to 40 per cent in freight rates.

(*c*) *Ocmulgee River, Georgia.*—In its original condition this river was used for navigation chiefly at high stages. At low water there were numerous shoals and snags, there probably being less than 2 feet on many sand bars and rock ledges.

The head of navigation on this river is Macon, a distance of 202 miles from the forks.

The original project was submitted in 1875 and provided for a channel 80 feet wide and 4 feet deep at low water, to be accomplished by the removal of sand bars, rock shoals, snags, overhanging trees, etc., from Macon to Darien, at a cost of $162,000.

The amount expended under this project and its modifications prior to operations under the existing project was $79,390.73.

The existing project of improvement, adopted by Congress September 19, 1890, provides for the establishment of a navigable channel 3 feet deep at ordinary summer low water from Macon to the river's mouth. This is to be obtained by removing rock shoals and sand bars, closing incipient cut-offs, revetting caving banks, and removing snags and logs from the channel and overhanging trees from the banks of the stream.

The cost of the improvement as given in the project of 1890 is estimated at $210,000, provided funds are regularly and adequately provided, besides from $3,000 to $5,000 for annual maintenance.

The amount expended under the present project up to June 30, 1909, was $278,367.49 (of which $27,483.76 was for maintenance), which, added to the amount previously expended, gives a total of $357,758.22.

A total of $802.26, received from sales of unserviceable property, have been received and deposited to the credit of the appropriation.

The work under the present project has resulted in a navigable channel from the forks to Macon. A great deal of work, however, remains to be done between Hawkinsville and Macon.

Work done during the fiscal year for maintenance consisted of the removal of 1,229 snags and 167 stumps from the channel, and the cutting of 944 overhanging trees and 89 logs on the banks; the repairing of training walls near Macon and at Tillman's bar and Hollingsworth Ferry, and the overhauling and repair of plant. Assistance was rendered by the snag boat *Oconee* to the sunken steamer *Small*, which prevented it becoming a wreck and thereby seriously obstructing navigation. For improvement, shore-protection dikes were constructed at Mansfield's place and Newton's place, aggregating 1,346 feet in length; a training wall 511 feet long was constructed at Newton's place; the Atwood jetty, near Macon, was extended 155 feet; Dike No. 3, near Macon, was extended 130 feet; 499 cubic yards of earth and 933 cubic yards of stone removed from Taylors Bluff shoals, near Hawkinsville; surveys were made of Oaky Bluff shoals and at two other localities, with a view to their improvement, and a temporary pile driver, 2 temporary barges, and 4 portable shacks for quartering laborers, constructed.

On June 30, 1909, the controlling depth between the forks and a point 3 miles below Hawkinsville was about 3 feet at ordinary summer low water, and between the latter point and Macon it was about 2½ feet. The river occasionally falls a foot below the ordinary summer stage and frequently rises 20 feet above.

The proportion of the approved project accomplished up to June 30, 1909, was about 95 per cent.

It is proposed to apply the available balance and additional appropriation recommended in the removal of logs, snags, stumps, and overhanging trees, in the removal of rock and sand shoals, maintaining existing training dikes and shore protections, and in the construction of additional dikes and shore protection where necessary, and in the closing of incipient cut-offs and opening others wherever deemed advisable.

The additional work proposed is for extension of benefits.

No reliable statistics of the commerce of the river before improvement was begun are available. In 1908 the freight carried on the river amounted to 18,700 tons, valued at $900,000. Besides this, 26,007,000 feet b. m. of timber was rafted down the river, valued at $288,800.

As nearly as can be determined, the effect of the improvement has been to cause a reduction of from 25 to 40 per cent in freight rates. A list of the Annual Reports of the Chief of Engineers and of executive documents containing the various projects, history of the work, maps, etc., may be found printed on page 282 of the Annual Report of the Chief of Engineers for 1905.

Reference to report on examination of the river ordered by the river and harbor act of March 3, 1905, will be found on page 311 of the Annual Report of the Chief of Engineers for 1906.

The emergency river and harbor act of March 3, 1909, called for an examination and survey of the Ocmulgee River between Macon and Hawkinsville, with a view to its improvement by locks and dams, and, in addition, for a general survey of the Altamaha River system, of which the Ocmulgee forms a part.

CONSOLIDATED.

July 1, 1908, balance unexpended		$40,764.18
Amount allotted from appropriation by river and harbor act approved March 3, 1909		40,000.00
		80,764.18
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$18,787.72	
For maintenance of improvement	13,001.87	
		31,789.59
July 1, 1909, balance unexpended		48,974.59
July 1, 1909, outstanding liabilities		3,786.23
July 1, 1909, balance available		45,188.36
Amount (estimated) required for completion of existing project		[a] 182,492.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		90,000.00

CLUB AND PLANTATION CREEKS, GEORGIA.

A project for dredging a canal 7 feet deep at mean low water, with a bottom width of 50 feet, to connect these two creeks and thus provide an inside route between the Altamaha River and its tributaries and Brunswick Harbor for use of light-draft river boats and timber rafts, will be found printed as House Document No. 159, Fifty-eighth Congress, second session. Besides the dredging of the canal, the project provides for the straightening of Plantation Creek and for dredging in both Club and Plantation creeks where necessary to give a channel 7 feet deep at mean low water. The estimated cost of the work is $40,700. This project was adopted by act of Congress approved March 2, 1907, which appropriated $20,000 toward its completion.

No work has yet been done. Portions of the route cross marsh land owned by private individuals and the city of Brunswick, Ga., and no provision was made in the act for the purchase of a right of way.

During the previous fiscal year a legal title was secured, without costs to the United States, from the city of Brunswick for that portion of the desired right of way owned by the city. During the past fiscal year efforts have been continued to secure the necessary legal title from the owners of the balance of the marsh land through which it is desired to dredge the proposed canal, the written permits obtained from the attorneys of these parties the year previous having been held by the Judge-Advocate-General of the Army to be insufficient.

At the close of the year the consent of all owners of the desired right of way to execute the necessary grants to the United States, free of cost, had been obtained, with the exception of one part owner, with whom negotiations were in progress.

[a] Does not include Ocmulgee River.

It is proposed to apply the available balance and additional appropriation recommended to the completion of the project, as soon as a valid right of way is obtained.

July 1, 1908, balance unexpended	$20,000.00
July 1, 1909, balance unexpended	20,000.00
Amount (estimated) required for completion of existing project	20,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	20,700.00

FLINT RIVER, GEORGIA.

Originally this river was navigable at low water from its mouth to Bainbridge, a distance of 36 miles, for boats drawing 3 feet, but the channel was narrow, crooked, and greatly obstructed by logs, snags, and overhanging trees. Above Bainbridge the channel was so obstructed by rock shoals, loose rock, and bowlders that there was no navigation except on a rise of 5 feet, when steamboats could run to Albany, 105 miles above the mouth. Above Albany to Montezuma, 182 miles from the mouth, the channel was so obstructed by sand and rock shoals, bowlders, snags, logs, and overhanging trees that the river was not navigable at a low-water stage.

The original project called for a channel 100 feet wide and 3 feet deep at extreme low water from the mouth of the river to Albany, Ga., at an estimated cost of $184,862.

This project was extended in 1879 to give a channel for light-draft steamers at moderate stages of water from Albany to Montezuma by the removal of logs, snags, and overhanging trees, cutting through rock reefs, and deepening sand bars by contraction works, at an additional cost of $15,000.

The amount expended up to the close of the fiscal year ending June 30, 1909, was $281,711.41, practically all being for permanent work. As a result of the work done, the river is now navigable throughout the year from Albany down to a point about 7 miles below Newton, 40 miles, and from Bainbridge to the mouth, 36 miles, there being a good channel with 3 feet available at low water throughout these sections. The project is about 70 per cent completed.

Between Bainbridge and Newton, for a distance of 29 miles, the river is navigable for light-draft boats only, and the channel is narrow and still much obstructed by bowlders and rock reefs. Considerable work has been done between these points, and operations for the next few years will be confined to this portion of the river. When the improvement of this section has been completed the river will be open to navigation at low water from its mouth to Albany, Ga.

The section between Albany and Montezuma, 77 miles, is still much obstructed, although it has been repeatedly cleared of snags and similar obstructions in accordance with the project.

The water level varies from 0 to 40 feet.

During ordinary low water Albany, Ga., is the head of navigation, but in periods of extreme low water, such as occurred during the fall of 1904, interruptions occur in the section between Bainbridge and Newton.

The commerce consists principally of cotton, naval stores, provisions, general merchandise, saw logs, and timber for export. Several very large sawmills are located at Bainbridge, but no record of the amount of lumber manufactured is kept, as shipments are made by rail. A large part of the saw logs used by these mills comes down the river. The commerce of the lower part of this stream is so combined with that of the Chattahoochee and Apalachicola rivers that it is impossible to give a statement in regard to it. The commerce of that part above Bainbridge is estimated to be about 2,800 tons, valued at $100,000.

It is proposed to apply the available balance and the funds recommended toward making the improvement below Albany fully available by widening the channel in many places between Bainbridge and Newton, and removing many obstructions to secure the width of 60 feet and the depth of 3 feet now available in the section above.

This work is largely permanent rock work, and its completion will greatly benefit the section of country between Albany and the mouth of the river. There are many turpentine stills in operation on the river which depend upon the water transportation for their products and supplies.

The effect of the improvement on freight rates, if any, can not be determined.

July 1, 1908, balance unexpended	$9,638.18
Amount allotted from appropriation by river and harbor act approved March 3, 1909	25,000.00
	34,638.18
June 30, 1909, amount expended during fiscal year, for works of improvement	10,349.59
July 1, 1909, balance unexpended	24,288.59
July 1, 1909, outstanding liabilities	1,494.24
July 1, 1909, balance available	22,794.35
Amount (estimated) required for completion of existing project	37,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	25,000.00

SAVANNAH RIVER ABOVE AUGUSTA, GA.

This portion of the Savannah River is navigable only by pole boats from the locks, 7 miles above the city of Augusta, to Petersburg, a distance of 48 miles. In its original condition the river at low water was navigable only with great difficulty, on account of shallow water, obstructing logs, etc.

The original project of improvement, submitted February 8, 1879, provided for a 3-foot channel, 30 feet wide, from Augusta, Ga., to Trotters shoals and the removal of snags, trees, etc., to the Tugaloo River, at a cost of $45,000.

Under this project there was expended, prior to operations under the existing project, $39,000.

The existing plan of improvement, adopted by Congress July 13, 1892, provides for the establishment, between Petersburg and the locks, of a downstream channel 12 to 25 feet in width and navigable

during ordinary summer low water for pole boats drawing 2 feet and of an upstream channel navigable for pole boats drawing 1.3 feet of water. This is to be obtained by removing logs and overhanging trees; excavating rock, sand, or gravel, and with excavated materials raising crests of ledges; constructing training walls, to increase flow of water through sluices. The total estimated cost is $33,000.

The total amount expended under the present project up to June 30, 1909, was $24,004.40, which, added to that previously expended, gives a total for this work of $63,004.40. No funds have been expended for maintenance.

The work accomplished under this project has given a downstream channel about 2 feet deep and an upstream channel of the project depth. In many places, however, these channels are difficult to navigate and are capable of greater improvement.

The proportion of the approved project accomplished up to June 30, 1909, was about 60 per cent.

Authority has recently been granted to a private company to construct a dam across the Savannah River about 20 miles above the dam at Augusta, to be 60 feet high and provided with locks of sufficient size to pass an ordinary river steamboat. The pool formed by this dam will drown out the principal shoal on that portion of the river now under improvement, and when this dam is completed and the lock ready for operation, a new survey should be made and a new project prepared to conform to the new conditions.

The work of the year was for improvement and consisted in the removal of 52 snags, 111 logs, and 52 cubic yards of loose rock from the channel and cutting 294 overhanging trees from the banks, and the placing of 440 cubic yards of rock in repairing existing dams.

It is proposed to apply the available balance and the additional appropriation recommended toward the removal of obstructions and the widening and deepening of the channel.

The additional work proposed is for extension of benefits.

In 1876–77 about 2,000 tons of freight went upstream and about 12,000 bales of cotton came down.

Complete figures for the commerce of 1908 were unobtainable for the reasons set forth in Appendix O 3. It is probable that such commerce did not differ greatly from the customary amount for the past eight years, which averaged 2,995 tons, valued at $169,780.

The commerce consists of cotton, grain, fertilizers, hay, cord wood, and general merchandise, and is carried on exclusively by pole boats.

The effect of the improvement has been to render navigation safer and easier, but it is impossible to determine whether it has caused any reduction in freight rates.

July 1, 1908, balance unexpended	$2,710.83
June 30, 1909, amount expended during fiscal year, for works of improvement	1,715.23
July 1, 1909, balance unexpended	995.60
Amount (estimated) required for completion of existing project	8,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for work of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	3,000.00

SAVANNAH RIVER AT AUGUSTA, GA.

Report on a recent survey is printed in House Document No. 487, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, January 6, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated April 30 and December 3, 1909, by Col. Dan C. Kingman, Corps of Engineers, on preliminary examination and survey, respectively, authorized by the river and harbor act approved March 3, 1909, of Savannah River at Augusta, Ga., with a view to determining what improvements are necessary in the interest of navigation.

This river between Savannah and Augusta is now under improvement with a view to securing a navigable steamboat channel 5 feet deep at ordinary summer low water, and aside from the removal of snags, logs, etc., but little work is required, except in the stretch of about 20 miles next below Augusta, where the river is at its worst. A special report has been made to cover that portion of the river and is printed in House Document No. 962, Sixtieth Congress, first session.

The district officer states that as the city of Augusta is situated at the very point where the slope of the river changes from a steep to a gradual incline, it is subjected to sudden and severe freshets, and these at times attain a level above the site on which the city stands, thus producing very destructive overflows. These freshets develop a very high velocity of current, which attacks the banks of the stream, particularly on the Augusta side, and with every high freshet a loss of bank occurs. Material thus eroded is carried into the river below and furnishes the material with which the bars are made, which prevent or obstruct navigation at low water and render the improvement of the river by regulation almost impossible. Therefore, in the opinion of the Board of Engineers for Rivers and Harbors, the protection of the bank of the river at Augusta is a work of prime importance to the navigation of the stream, and to accomplish this in a manner favorable to the utilization of the water front for landing places, it is desirable to adopt a more substantial construction than would otherwise be necessary.

The district officer accordingly submits a project providing for the riprapping of the bank, at a total estimated cost of $250,000, and he believes that it would be proper and just for the United States to pay one-half of the cost of this work, provided the city of Augusta will furnish the means to complete it in exact accordance with the plans presented. The Board of Engineers for Rivers and Harbors concurs in this opinion.

I concur with the district officer, who is also division engineer, and the Board of Engineers for Rivers and Harbors that this locality is worthy of improvement by the General Government in the manner proposed.

The question of terminal facilities has received consideration in connection with this subject, but no questions of water power or similar subjects not considered in the reports are involved in the consideration of this subject.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

The local officer, in his report, says:

It may be proper to state that the city of Augusta is greatly interested in navigation, and has provided already one wharf with a good warehouse for the use of all steamboats upon equal and very reasonable terms. I have no doubt that others will be provided, either by municipal action or individual construction, as they are needed with the greater development of commerce.

SAVANNAH RIVER, GEORGIA AND SOUTH CAROLINA.

Following is the report of the Board of Engineers on a recent survey, which is printed in House Document No. 962, Sixtieth Congress, first session. The Chief of Engineers concurs.

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., April 13, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

From the within report on a survey of the Savannah River for the 30 miles below the city of Augusta it appears that the project depth of 5 feet between the cities of Savannah and Augusta has been secured, except for the 20 or 25 miles next below Augusta, and that in order to provide this depth throughout this reach a more radical improvement will be required than has heretofore been carried on under the existing project. The district officer suggests a plan of improvement by open-river methods, involving bank protection, training walls or dikes, repair of existing work, and the construction and operation of a new dredge. He estimates that this work will cost $360,000 and that the maintenance of the entire project will then require an expenditure of about $10,000 per year for an unknown period until a more stable regimen is established, after which it may be possible to reduce the cost of this item to $4,000 or $5,000. He believes the river is worthy of improvement to the extent proposed.

It is reported that the commerce for 1906 amounted to 54,800 tons, valued at $5,410,000, consisting principally of cotton and cotton-factory products, naval stores, fertilizers, and general merchandise. In addition to this commerce, there was rafted down the river about 17,000,000 feet b. m. of timber, valued at about $186,000. It is also reported that the effect of the improvement on this river has been a reduction of from 30 to 50 per cent in freight rates, according to the nature of the commodity.

It appears that the successful navigation of the Savannah River between Augusta and Savannah, a distance of over 200 miles, is in a great measure dependent upon the condition of the river in the short stretch now under consideration, and that if this reach is improved so as to secure a depth of 5 feet this depth can at small cost be maintained below, thus making a continuous 5-foot navigation possible between the two principal points on this stream. The Board concurs with the district officer in believing the river worthy of improvement to the extent proposed by him, and therefore recommends the adoption of the project outlined within.

CHATTAHOOCHEE RIVER, GEORGIA AND ALABAMA, BELOW COLUMBUS.

Columbus, Ga., is 223 miles above the junction of this river with the Flint River and 360 miles above the mouth of the Apalachicola River, formed by the confluence of the Chattahoochee and Flint. Originally boats drawing 22 inches were able to reach Columbus for about nine months each year, but navigation was difficult and dangerous by day and impossible by night, owing to the large accumulation of logs, snags, and overhanging trees, and to sand, rock, and marl shoals obstructing the channel.

The project for the improvement, adopted in 1873, provided for a low-water channel 100 feet wide and 4 feet deep from Columbus, Ga., to Chattahoochee, Fla., at the junction of the Flint, which was to be obtained by the removal of logs, snags, and overhanging trees, cutting through the rock and marl shoals, and scouring out sand bars by works of contraction and shore protection. The estimated cost of this work from Chattahoochee, Fla., to Eufaula, Ala., 139 miles, was $145,247, but no estimate of cost for that part between Eufaula and Columbus was ever made.

The amount expended on this work to the close of the fiscal year ending June 30, 1909, was $723,643.33, largely expended in maintenance, removing the annual influx of obstructions brought in from caving banks. The project is about 80 per cent completed in the upper section above Eufaula and about 10 per cent in the lower section.

No increased depth, except in the upper part of the river, has been gained; but by removing the logs, snags, and overhanging trees, removing the sand, gravel, marl, and rock reefs, and regulating the channel immediately below Columbus, the river has been kept open to navigation. As nearly all the land along the banks of the river and its tributaries has been gradually cleared, each rainy season has brought increasing quantities of sand into the river, filling the original river bed with shifting sand and gravel bars and greatly changing its regimen. Four feet draft can be carried at ordinary low water, but at extreme low water scant 3 feet is the maximum draft than can be counted upon.

Below Eufaula, Ala., the river is now in a fair condition, with an available low-water depth of 3½ feet, but between Eufaula and Columbus there are a number of bars and isolated obstructions which cause trouble, particularly at extreme low water. The most serious of these obstructions was a series of sand bars, formed in the river from the wharves at Columbus down to Mary Freemans bar, 3 miles below, which made it impossible for steamboats to reach Columbus, and the head of navigation during the period of extreme low water was therefore Mary Freemans bar.

During the last few years more liberal appropriations have permitted a more vigorous prosecution of work, and considerable progress has been made on the permanent improvement of the river. In addition to maintaining the river free from snags and obstructions, the channel for a distance of 32 miles below Columbus has been regulated by a system of jetties, and the most serious bars in the upper river have been kept open by dredging where necessary. As a result of this work, Columbus has become the head of navigation, and boats are able to reach there at all times except during unusually low water, such as occurred in the fall of 1904, putting a stop to all navigation.

A large number of other sand bars and shoals between Columbus and Eufaula still need improvement, the regulating works already built require repairs and maintenance, and the annual accumulation of snags and other obstructions must be removed from the river throughout its length.

It is proposed to apply the funds available and the appropriation recommended to this work, the regulating works to be extended down the river from the foot of the present permanent improvement.

The variation of the water level is 0 to 47 feet at Columbus.

The commerce of this stream consists of cotton, cotton seed, fertilizers, grain, naval stores, provisions, hardware, and general merchandise, and is so combined with that of the Flint and Apalachicola rivers that a separation is impossible. It is given under the report of the Flint River as 121,717 tons, valued at $12,000,000.

The effect of the improvement has been to give to Columbus and all other points on the river water rates, or a material reduction over

rates to all-rail points, but the exact amount of reduction can not be stated.

For reference to report of examination of this river, see Annual Report of the Chief of Engineers for 1906, page 341.

July 1, 1908, balance unexpended		$81,196.50
Amount allotted from appropriation by river and harbor act approved March 3, 1909		115,000.00
		196,196.50
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$45,000.00	
For maintenance of improvement	36,909.05	
		81,909.05
July 1, 1909, balance unexpended		114,287.45
July 1, 1909, outstanding liabilities		13,634.62
July 1, 1909, balance available		100,652.83
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		[a]115,000.00

COOSA RIVER, GEORGIA AND ALABAMA.

The Coosa is formed at Rome, Ga., by the junction of the Oostenaula and Etowah rivers, which have their sources in northern Georgia. The Oostenaula is formed by the junction of the Coosawattee and Connesauga rivers, 56 miles northwest of Rome. The Oostenaula above Rome, Ga., and its tributary, the Coosawattee, are navigable for light-draft boats during nine months of the year for a distance of about 105 miles, but the Etowah and the Connesauga are not navigable.

The Coosa River has always been navigable for light-draft boats from Rome, Ga., to Greenport, Ala., an estimated distance of 162 miles, and this part of the river is of such a character as to make its improvement by works of contraction and channel excavation entirely practicable, except at Horseleg shoals, near Rome, Ga., where a lock of low lift will be ultimately required.

From Greenport, Ala., to Wetumpka, Ala., a distance of 142 miles, locks and dams are required in conjunction with works of contraction and channel excavation to provide for navigation.

From Wetumpka to the junction of the Tallapoosa River the river is navigable at all seasons.

The ordinary variations of the water surface are, at Rome, Ga., 0 to 30 feet; at Greenport, Ala., 0 to 15 feet; at Wetumpka, Ala., 0 to 50 feet.

The improvement of these rivers is provided for under the two following projects (for reference to report upon proposed modifications of projects for improving the Coosa River, see Annual Report of the Chief of Engineers for 1905, p. 326):

(*a*) *Coosa River between Rome, Ga., and East Tennessee, Virginia and Georgia Railroad bridge.*—The original project for the improvement of the Coosa River contemplated the opening of a continuous

[a] Item of $40,000 for dredge may be omitted, thus reducing this estimate to $75,000.

water route of transportation from the Mississippi River to the Atlantic Ocean by way of the Ohio, Tennessee, Coosa, Etowah, Ocmulgee, and Altamaha rivers, with canals from the Tennessee to the Coosa and from the Etowah to the Ocmulgee. This was designated as the "southern route."

Various examinations and estimates for the improvement of parts of this section of river have been made from time to time up to the adoption of the existing project, September 19, 1890. This project, as modified by act of Congress of July 13, 1892, formed a part of a plan submitted in 1875 for a proposed waterway from the Mississippi to the Atlantic via the Tennessee River, and provides for a crib and timber lock 200 by 32 feet and a 3-foot lift, with excavation for a 4-foot channel between Rome, Ga., and Wills Creek in Alabama, at a total estimated cost of $180,000; for three locks between Greenport and Dam 4 (Whisenant and Ten Island shoals), 210 feet long, 40 feet wide, and an extreme low-water depth of 4 feet on miter sills, together with a 3-foot channel between Locks 1 and 3, at a total estimated cost, including accessory dams and dikes, of $155,616.23; for five locks and dams from and including Dam 4 to the East Tennessee, Virginia and Georgia Railroad bridge, the locks to have an available length of 280 feet, width of 52 feet, and an extreme low-water depth of 6 feet over the miter sills, together with a connecting channel 100 feet wide and 4 feet deep at extreme low water, at a total estimated cost of $1,160,491, or at a total cost for the entire improvement of $1,496,107.23. About 21 per cent of the project has been completed.

To June 30, 1909, there has been expended on this section of the Coosa $1,101,016.88, of which $577,316.88 has been expended upon the existing project and $523,700 prior to its adoption. The work accomplished is as follows, of which expenditures about 10 per cent has been for maintenance:

Locks 1, 2, and 3, Coosa River, commenced prior to 1890, have been completed. They are situated, respectively, 0.68 mile, 3.86 miles, and 5.24 miles below Greenport, Ala., and have available lengths of 175 feet and widths of 40 feet.

Lock and Dam 4 (25.89 miles below Greenport), commenced since the adoption of larger dimensions above mentioned, has, together with its appurtenances, been under construction, with desultory appropriations, since 1886, but still incomplete.

Channel improvement has been extended as far down as Dam 4, and navigation is now possible to this point, except at extreme low water, when interruptions occur a short distance above Dam 4.

During the past fiscal year work was confined to the improvement and maintenance of the channel between Rome, Ga., and Dam 4, Alabama, and to care of the large amount of plant on hand. Provision should be made for further improvement and maintenance of this channel.

On June 30, 1909, the maximum draft that could be carried at ordinary low water between Rome, Ga., and Dam 4 was 3 feet, except at Horseleg shoal, 1½ miles below Rome, over which but 2 feet can be carried until a lock is constructed at this point. Survey and estimate for this lock have been submitted.

It is proposed to apply the additional appropriation recommended toward further improvement and maintenance of the channel between Rome, Ga., and Dam 4, Alabama.

The improvement has resulted in a reduction in railroad rates between points on the river and either Rome or Gadson of not less than 50 per cent, water rates controlling all shipments to and from the country contiguous to the river.

The commerce of this portion of the Coosa consists principally in cotton, cotton seed, fertilizers, timber, lumber, staves, grain, and miscellaneous articles, amounting, for the year 1908, to 24,189 tons, valued at $2,500,000. Lumber and logs valued at $73,000 were also reported as moved.

(*b*) *Coosa River between Wetumpka and East Tennessee, Virginia and Georgia Railroad bridge.*—On account of the numerous rapids this part of the river has never been navigable.

The original project for the improvement of this section of the river adopted September 19, 1890, as the result of a survey made in 1889 and modified by Congress July 13, 1892, contemplates slack-water navigation and provides for the construction of 23 locks and dams of varying lifts, of an available length of 280 feet and width of 52 feet, with 6 feet over the miter sills, no lift of lock to exceed 15 feet. In addition, the channel is to be cleared of various rock reefs and points so as to give a least depth of 4 feet, all at an estimated cost of $5,106,422. About 4 per cent of the project has been completed.

There has been expended on this project to June 30, 1909, $401,372.22, of which about 2½ per cent has been for maintenance, which has resulted in the construction of the lowest lock of the series, known as "No. 31," excepting the dam and grates, the excavation of the channel between this lock and the one next above, and the preparation of data and plans for additional locks and dams, but these data are still incomplete. As yet no benefit has been derived from this improvement, and its value is entirely dependent on the completion of the entire system.

Provision should be made for the care of the property belonging to the improvement.

CONSOLIDATED.

July 1, 1908, balance unexpended		$30,530.68
Amount allotted from appropriation by river and harbor act approved March 3, 1909		40,000.00
		70,530.68
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$21,906.79	
For maintenance of improvement	5,000.00	
		26,906.79
July 1, 1909, balance unexpended		43,623.89
July 1, 1909, outstanding liabilities		3,204.91
July 1, 1909, balance available		40,418.98
Amount (estimated) required for completion of existing project		6,059,913.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		60,000.00

COOSA RIVER LOCK AND DAM AT MAYOS BAR, GEORGIA.

Report on a recent survey is printed in House Document No. 1115, Sixtieth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 4, 1908.

SIR: I have the honor to submit herewith for transmission to Congress reports of September 4, 1907, by Capt. J. B. Cavanaugh, Corps of Engineers, and October 8, 1908, with map, by Capt. H. B. Ferguson, Corps of Engineers, on preliminary examination and survey, respectively, authorized by the river and harbor act approved March 2, 1907, of Coosa River at Horseleg shoals, near Rome, Ga., with a view to the construction of a lock and dam.

The necessity for a lock and dam at this locality has been recognized for many years, but no steps toward actual construction have ever been taken. In his survey report of October 8, 1908, Captain Ferguson submits alternative estimates for locks 272 feet long and 40 feet clear width, and 400 feet long and 56 feet clear width, the smaller dimensions conforming in general to those of the locks now in operation on upper Coosa River, and the larger dimensions to those for the locks proposed for the lower river. Alternative locations at Shorters Island and Mayos bar, both below Horseleg shoals, are also considered for the lock and dam now in contemplation. He recommends the larger lock at or near Mayos bar, estimated to cost $335,870, and regards the locality as worthy of improvement to this extent. The views of the district officer are recommended for approval by the division engineer, Lieut. Col. Lansing H. Beach, Corps of Engineers.

It its final report of November 2, 1908, also herewith, the Board of Engineers for Rivers and Harbors recommends the improvement of this portion of Coosa River by the construction of the smaller lock at or near Mayos bar, at an estimated cost of $241,039. In the opinion of the Board, the necessities of commerce do not require at this place a lock of greater dimensions than those pertaining to the locks which have already been constructed and which serve a similar commerce.

I concur in the views and recommendations of the Board of Engineers for Rivers and Harbors.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

The upper Coosa River is under improvement by the United States with a view to securing a navigable depth of about 4 feet, the project contemplating a lock and dam in the vicinity of Horseleg shoals, open-river improvement between that point and Greensport, Ala., a distance of about 160 miles, and a further extension of the improvement down stream by locks and dams to the East Tennessee, Virginia and Georgia Railroad bridge. Locks 1, 2, and 3 have been completed, some work done on No. 4, and considerable open-river improvement in the upper stretch has been carried on for a number of years. The completion of Dam No. 4 by private parties has been authorized by Congress. This will carry the improvement to a point about 26 miles below Greensport. With the exception of Horseleg shoals, situated about 1 mile below Rome, where there is but 15 to 24 inches of water at low stages, there exists a navigable depth at all stages over the entire reach of about 200 miles.

There is considerable commerce on this section of the river now, that for the fiscal year ending June 30, 1907, being estimated at 124,078 tons, valued at $3,500,000, and new industries are reported, which indicates that a further improvement of the river will result in an increase in commerce. It is evident that the obstruction at these

shoals, over which most of the commerce must pass, is a serious hindrance to navigation.

The construction of a lock and dam at this point has been a part of the project since the work was originally undertaken many years ago, but no funds for its prosecution have been provided.

Following is the report of the Board of Engineers:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., November 2, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

As stated in paragraph 3 of the Board's indorsement of September 23, 1907, reviewing the report on preliminary examination, the construction of a lock and dam to carry navigation over Horseleg shoals has been a part of the project since the work was undertaken many years ago, but no funds have been appropriated for the purpose. While the original plan contemplated the construction of a timber lock 200 by 32 feet, with a 3-foot lift, a structure of this character would not meet present needs and conditions,

The district officer is of opinion that the most advantageous location for a lock and dam to accomplish the purpose specified is at or near Mayos bar. He estimates the cost of a structure 272 feet over all by 40 feet, with a 9-foot lift, at $241,039, while a lock 400 feet by 56 feet, of the same lift, is estimated to cost $335,870, both estimates covering the cost of lock and dam, gates, valves, maneuvering gear etc., and of the land required for the reservation. He recommends the construction of the 400-foot lock at the cost mentioned, and in this recommendation the division engineer concurs.

The district officer states that the smaller lock, 272 feet long over all and 40 feet clear width, would be similar in all essentials to Locks 1, 2, and 3 now in operation on Coosa River. The Board does not believe that the necessities of commerce require at this place a lock of greater dimensions than those pertaining to the same project which have already been constructed, and which serve a similar commerce. Therefore the Board recommends the improvement of this portion of the Coosa River by the construction of the smaller lock at or near Mayos bar, at an estimated cost of $241,039.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

COOSA RIVER, DAMS 4 AND 5, ALA.

Report on a recent survey is printed in House Document No. 1421, Sixtieth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, February 3, 1909.

SIR: I have the honor to submit herewith for transmission to Congress reports of September 4, 1907, by Capt. (now Maj.) J. B. Cavanaugh, Corps of Engineers, and October 8, 1908, by Capt. H. B. Ferguson, Corps of Engineers, on preliminary examination and survey, respectively, authorized by the river and harbor act approved March 2, 1907, of Coosa River, Georgia and Alabama, with a view to locating and constructing Dam No. 5, in the State of Alabama.

In the improvement of the upper Coosa River there have already been constructed three locks and four dams located, respectively, 0.68, 3.86, 5.24, and 26 miles below Greensport, Ala., and the present investigation has for its object the consideration of the question of supplementing this work by an additional dam just below the existing structures, by which slackwater would be extended a farther distance of about 12 miles to the towns and railroad crossing below Dam No. 4.

In his survey report of October 8, 1908, Captain Ferguson recommends locating Dam No. 5 at Choccolocco shoals, and submits an estimate of its cost, amounting to $134,000. I concur in the opinion of the local officer, the division engineer, and the Board of Engineers for Rivers and Harbors that Coosa River

is worthy of further improvement by the construction of Dam No. 5, upon condition, however, that existing Dam No. 4 be supplied with a lock to make navigation possible through the dam.

As it exists to-day Dam No. 4, without a lock, is such an obstruction to navigation as would not be tolerated were it maintained by private interests. It is a complete bar to navigation by boats, and its presence imposes a direct tax upon all timber bound to the mills below, which, under existing conditions, must be passed over the dam. Indeed, it is a question whether commerce and traffic would not be better served were the river at this point left open for use at periods of high water, when navigation of the open channel would be possible if the dam did not exist.

The dam having been built, however, it would seem that the Government is under a moral obligation to complete its work by providing a lock through which navigation may be possible to the towns and railroad below, which are the natural objective points for the commerce on this section of the river. Reports now before Congress show that Lock and Dam No. 4 can be completed at a cost of $282,000. (Annual Report of the Chief of Engineers for 1905, p. 1378.)

There is now before Congress a bill to revive the provisions of an act approved June 4, 1906, by which private parties were authorized to complete Dam No. 4 (including forebay of the lock, buttresses, and gates) for power purposes. Should the bill now pending become a law and the parties interested avail themselves of the privilege conferred, the lock could be completed by the United States at comparatively small expense.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

THE SECRETARY OF WAR.

During the last fiscal year the commerce on this section of the Coosa River amounted to 124,078 tons, valued at $3,500,000, and it is expected that this local commerce will be largely increased when the connection is complete between Rome and Gadsden and the towns on the Coosa River immediately below Dam 4.

WATER ROUTE BETWEEN SAVANNAH, GA., AND FERNANDINA, FLA.

This route consists of a series of bays and tidal sloughs, making a connecting waterway not exposed to rough water except at a few points in stormy weather. The waters forming the route are shown on Coast Survey charts Nos. 156 and 157. It is navigable from Savannah, Ga., to Fernandina, Fla., Brunswick, Ga., and Darien, Ga. The distance from Savannah to Fernandina is 160 miles. Touching at Darien en route increases this by about 20 miles and at Brunswick by about 12 miles.

The project of improvement was adopted in 1892 and provides for the establishment of a channel 7 feet deep at mean low water. This is to be accomplished by the improvement of Romerly Marsh, Mud River, Little Mud River, and Jekyl Creek. The estimated cost of the improvement was $105,000, provided the entire sum be made available at one time.

The total amount expended under this project up to June 30, 1909, was $128,352.47 (of which $63,842.53 was for maintenance), which, added to the amount expended for Jekyl Creek and Romerly Marsh, $71,108.77, makes a total of $199,461.24.

The original estimate for the improvement of this route was completed with the appropriation of $41,000 made by the river and harbor act of March 3, 1905, but the improvement was still unfinished. This resulted from the small appropriations made, extending the

work over a very long period, as fully set forth in a report of the district officer printed on page 1208 of the Annual Report of the Chief of Engineers for 1906. The river and harbor act of March 2, 1907, provided for a resurvey of the waterway to determine the best route for further improvement. Report of this resurvey, with estimate of cost, is printed as House Document No. 1236, Sixtieth Congress, second session.

All work done during the fiscal year was for maintenance, and consisted of the dredging of a total of 88,401.6 cubic yards of material, under contract, from shoals at the mouth of St. Augustine Creek, in the Florida Passage, Little Mud River, Frederica River, Jekyl Creek, and Cumberland Dividings, and the raising and extending of the training wall near the head of Jekyl Creek and the raising of the jetty near the mouth of this creek. Work was in progress at the close of the fiscal year.

The completion of the work at Skidaway Narrows (see report herewith) has made this an integral part of the inside route, shortening the distance by 6 miles between Savannah and Fernandina and rendering further work by the way of Parson's cut unnecessary. This makes the proportion of the approved project accomplished up to June 30, 1909, 90 per cent, and Skidaway Narrows should hereafter cease to be regarded as an independent work, but be treated as a portion of the inside route.

On June 30, 1909, the controlling depth between Savannah and Fernandina was 6 feet at mean low water, by way of the new route through Skidaway Narrows, except at the mouth of Mud River, where the controlling depth was 5 feet. By way of the old route through Parson's cut the controlling depth was 2 feet. By waiting on the tides, however, at Parsons cut, Skidaway Narrows, and Mud River a navigation in excess of 7 feet could be carried by either route between Savannah and Fernandina. The mean rise and fall of the tide varies at different localities from 6.5 feet to 8 feet.

It is proposed to apply the available balance and additional appropriation recommended toward restoring and maintaining a 7-foot navigation, at mean low water, throughout the entire route.

The additional work proposed is for extension of benefits.

The value of the commerce passing over this route was estimated in 1890 at between $200,000 and $300,000 per annum. During the calendar year 1908 the commerce amounted to 60,000 tons of freight, valued at $2,300.000. There was also rafted on this route during 1908, 58,985,000 feet b. m. of timber, valued at $787,500. Little, if any, of this commerce passed over the whole extent of the route.

It is impracticable to determine the effect of this improvement upon freight rates, as at present the different portions of the route are used locally, and comparatively few vessels engaged in commerce pass over the entire length of it.

July 1, 1908, balance unexpended	$24,478.20
Amount allotted from appropriation by river and harbor act approved March 3, 1909	25,000.00
	49,478.20
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	17,830.67

July 1, 1909, balance unexpended	$31,647.53
July 1, 1909, outstanding liabilities	3,810.90
July 1, 1909, balance available	27,836.63
July 1, 1909, amount covered by uncompleted contracts	1,945.45
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	25,000.00

Report on a recent survey is printed in House Document No. 1236, Sixtieth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 14, 1908.

SIR: I have the honor to submit herewith, for transmission to Congress, report of October 5, 1908, with map, by Col. Dan C. Kingman, Corps of Engineers, on resurvey of the inside water route between Savannah, Ga., and Fernandina, Fla., authorized by the river and harbor act approved March 2, 1907, to be made with a view to determining the best route of said waterway.

Improvement of this waterway as a whole has been carried on by the General Government since 1892, and has for its object the securing of a sheltered or landlocked route along the coast line between the points named, with a minimum low-water depth of 7 feet.

In the report herewith, Colonel Kingman recommends a continuation of the improvement to the same general depth but with increased width of channel, with a change of route at two points, and the addition of alternative or auxiliary channels at four other localities. The work recommended is explained at length in the local officer's report, and a brief résumé is given in the report of the Board of Engineers for Rivers and Harbors dated November 30, 1908 (also herewith). The estimated cost of this work is $237,700, of which $75,000 is for part payment for a new dredge boat to be owned by the Government, with which it is proposed that the necessary dredging shall be done, the balance ($25,000) of the estimated cost of the dredge to be paid from appropriations for other work on which it will also be employed. Colonel Kingman states that, should this plan be adopted, at least $150,000 should be made available with the first appropriation.

I concur in the opinion of the district officer and the Board of Engineers for Rivers and Harbors that this waterway is worthy of further improvement to the extent and in the manner indicated.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

HARBOR AT APALACHICOLA BAY, FLORIDA.

The town of Apalachicola lies at the mouth of the Apalachicola River, and the deep water along the river front forms the inner harbor.

At the mouth of the river, between the inner harbor and the 3-fathom anchorage area in Apalachicola Bay, there is a bar of which the original width between 8-foot contours was 7,000 feet and the minimum depth of water 3.5 feet. Across this bar the lumber exported is lightered either to the 3-fathom anchorage in Apalachicola Bay or through Bulkhead shoals to the anchorage of Carrabelle, 25 miles distant. The 3-fathom anchorage area is entered via West Pass, where originally the depth was about 13 feet. The original depth over Bulkhead shoals was less than 4 feet.

The original project, adopted June 14, 1880, provided for dredging a channel 100 feet wide and 11 feet deep through the bar at the mouth

of the river, the width of cut to be increased to 200 feet if the results justified this enlargement.

This project was amended September 19, 1890, to include dredging a channel 9 feet deep and not less than 100 feet wide across the Bulkhead shoals.

Upon this project as amended has been expended $154,000, of which $100,000 has been applied to maintenance in repeated dredging of the cut across the bar at the mouth of the river. The channel through Bulkhead shoals, dredged in 1891–2, remains practically unchanged, with a minimum depth of 8 feet at mean low water.

Prior to the adoption of any project of record in this office $18,700 was expended on this improvement—1833–1839—but the object and results of such expenditures are unknown.

By act approved March 3, 1899, a new project was adopted, which provided for a channel 100 feet wide, 18 feet deep at mean low water, through the West Pass along the northern shore of St. George Island and across the bay to the water front of Apalachicola, estimated to cost $350,000, and $20,000 or $30,000 annually for maintenance of completed work.

The amount expended on this project was $130,679.26, of which about $90,000 was for maintenance.

By act of Congress, approved March 2, 1907, a new project was adopted by which the previous project was amended so as to provide for a channel across the bar at the mouth of the Apalachicola River not less than 100 feet wide and 10 feet deep at mean low water and a channel not less than 150 feet wide and 18 feet deep through Link channel and West Pass to the Gulf of Mexico, at an estimated cost of $85,000, and $17,500 annually for maintenance after completion.

During the last fiscal year the channel 10 feet deep and 100 feet wide across the bar at the mouth of the river was completed. For protection of this channel from westward-moving silt, a bulkhead to the east of it was completed during the fiscal year. The length of this bulkhead is 6,900 feet.

About 75 per cent of the project is completed.

The amount expended on this project up to the close of the fiscal year ending June 30, 1909, was $84,871.68, of which $19,359.64 was for maintenance of project of 1899.

The hurricane of September 26–27, 1906, seriously damaged the channel across the outer bar at West Pass by extending the shoal at the western end of Sand Island across the dredged cut, filling it and forcing this part of the channel farther to the west.

The ordinary range of the tide is about 2 feet.

The commerce of this port is in timber, cotton, naval stores, staves, a large quantity of dressed and kiln-dried lumber, shingles, laths, and miscellaneous freight, and for the year ending June 30, 1909, is estimated at a valuation of $712,538.

On June 30, 1909, the maximum draft that could safely be carried through the West Pass entrance to the lower anchorage behind St. George Island was about 14 feet, and the maximum draft that could be carried across the bar at the mouth of the river was about 9 feet.

Reference to reports on examinations and surveys of this harbor will be found on pages 335 and 355 of Report of the Chief of Engineers for 1906.

It is proposed to apply the appropriation asked for to continuing improvement and for maintenance to keep the improvement available.

The portion of the project now completed gives greatly increased facilities to the commerce of this port and a substantial reduction in freight rates on coastwise commerce. The exact amount of this reduction and the reduction on foreign commerce can not yet be stated.

July 1, 1908, balance unexpended		$20,361.50
Amount allotted from appropriation by river and harbor act approved March 3, 1909		20,000.00
		40,361.50
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$11,052.80	
For maintenance of improvement	9,359.64	
		20.412.44
July 1, 1909, balance unexpended		19,949.06
July 1, 1909, outstanding liabilities		696.17
July 1, 1909, balance available		19,252.89
Amount (estimated) required for completion of existing project		25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		[a] 60,000.00

BISCAYNE BAY, FLORIDA.

Before improvement, Biscayne Bay was navigable for boats drawing less than 3 feet of water. There was a channel, excavated at private expense, 12.5 miles long with a least depth of 10.5 feet, from Miami to the Atlantic Ocean near Cape Florida. The tidal range in the bay is about 1 foot.

The river and harbor act of June 13, 1902, adopted in part a plan proposed by a Board of Engineer officers appointed in accordance with a provision in the river and harbor act of March 3, 1899. This plan contemplated a channel 18 feet deep from the wharves at Miami to the sea by way of a line entering the sea at a point about 4,000 feet north of Norris Cut, and a refuge basin of same depth, 1,200 feet long and 400 feet wide, in some suitable place, this channel to be protected by one or two jetties, as might be found necessary. The estimated cost of the entire improvement was $1,493,743. (See H. Doc. No. 662, 56th Cong., 1st sess.) The act of 1902 appropriated and authorized an expenditure of $300,000 for part of this work, and provided that the Florida East Coast Railway Company should construct, at its own expense, a basin 1,600 feet long and 500 feet wide adjacent to the wharves at Miami and the channel from said basin to the east side of the proposed refuge basin on the east side of the bay; that the amounts appropriated and authorized by Congress should be expended in constructing and protecting the portion of the channel extending to the sea from the terminus of the channel to be constructed by the railway company, of such approximately uniform depth and of such widths as would best serve the interests of naviga-

[a] The item of $20,000 for dredge construction may be omitted if the improvement of St. Andrews Bay is not authorized.

tion and as could be constructed with the funds appropriated and authorized. The act further provided that before any part of the appropriation should be expended the said railway company should enter into a contract with the United States for the performance of its part of the work.

The act of March 2, 1907, modified the project by prescribing a width of 100 feet for the dredged channel, and by providing for a jetty on the southern side of the entrance. The total estimated cost of the work authorized by Congress is $546,000, all of which has been appropriated.

The total expenditure up to June 30, 1909, was $363,720.58, of which $9,759.17 was for emergency work of maintenance by the construction of shore revetment.

As a result there is an available channel 10 feet deep across the bay, the two jetties are completed, and the progress on the necessary rock excavation in the channel between the jetties promises a completion of the present project during the next fiscal year.

During the year the steamers operating between Jacksonville and Habana made Miami a port of call.

The project is about 60 per cent completed. The channel is not open to navigation.

A description of the bay, with report and recommendations of a Board of officers, may be found in Report of the Chief of Engineers for 1900, pages 1986 to 2013. (See also Report for 1905, pp. 1300–1302.)

Tonnage by years: 1899, 18,089; 1902, 8,390; 1903, 13,319; 1904, 16,788; 1905, 40,700; 1906, 56,405; 1907, 106,010; 1908, 151,280.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, to maintenance.

July 1, 1908, balance unexpended	$265,580.62
Amount appropriated by sundry civil act approved March 4, 1909	27,000.00
	292,580.62
June 30, 1909, amount expended during fiscal year, for works of improvement	100,541.55
July 1, 1909, balance unexpended	192,039.07
July 1, 1909, outstanding liabilities	12,780.26
July 1, 1909, balance available	179,258.81
July 1, 1909, amount covered by uncompleted contracts	80,198.07
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

CARRABELLE BAR AND HARBOR, FLORIDA.

The town of Carrabelle is situated at the mouth of Carrabelle River, which empties into St. George Sound. The river forms the inner harbor and along the water front its channel varies from 9 to 14 feet in depth, with a minimum width of about 100 feet.

Dog Island anchorage, a protected portion of St. George Sound, showing a 4-fathom depth over a considerable area, forms the outer harbor. Between the 10-foot contours in the inner and outer harbors

there is a bar about 6,000 feet wide, which originally had a minimum low-water depth over it of 3½ feet to 4 feet.

Dog Island anchorage is connected with the Gulf of Mexico by East Pass, which originally had limiting low-water depths of about 17 feet on the outer bar and 16.5 feet on the inner bar.

The approved project for Carrabelle bar and harbor, Florida, adopted June 3, 1896, provides for dredging a channel 10 feet deep and 100 feet wide from Dog Island anchorage, St. George Sound, to the city of Carrabelle, at a cost estimated in 1900 at $47,300, in addition to appropriations already expended on the project amounting to $22,399.54. By act of Congress approved June 13, 1902, this project was extended to include the improvement of East Pass by dredging a channel across the bar 20½ feet deep and 150 feet wide, and closing an opening in Dog Island, at an estimated cost of $27,450. This part of the project is completed.

By act of Congress approved March 2, 1907, the project was further extended to include a channel 18 feet deep and 100 feet wide from the 18-foot contour in the outer harbor to a point opposite the beacon situated about 1,000 feet up the river from its mouth, with a suitable turning basin, but the size of the basin was not fixed by Congress, and the estimated cost of the extension of the project has not been determined.

The amount expended up to the close of the fiscal year ending June 30, 1909, was $148,866.15, of which $21,704.08 was expended prior to estimate of 1900, and about $46,110.98 has been applied to maintenance.

The channel at the mouth of the river has been partially dredged from time to time. During 1906 it was completed to a width of 100 feet and a depth of 10 feet from the wharves at Carrabelle to a point 1,400 feet south of the red beacon, and also widened 100 feet at the turn opposite Timber Island, but it shoaled at the inner end. During the past fiscal year a channel 100 feet wide and 10 feet deep has been completed from the wharves at Carrabelle to site of proposed turning basin.

The maximum draft that could be carried through the channel to the inner harbor on June 30, 1909, was 10 feet.

The shoaling of this channel is believed to be due largely to storm action, and it should be protected to the eastward. This will be largely accomplished by the work which the Georgia, Florida and Alabama Railway Company is to undertake.

In 1904 the channel across the outer bar was deepened by dredging from about 17 feet to 20 feet, and across the inner bar from about 16.5 feet to 17.5 feet, this limiting depth being confined to a short distance.

During the past fiscal year a channel across the outer bar was dredged 150 feet in width and 20½ feet in depth. The maximum draft that could be carried through this channel on June 30, 1909, was 20½ feet.

The ordinary range of the tide is about 2 feet.

The commerce of the port of Carrabelle consists principally of timber, naval stores, dressed and kiln-dried lumber, shingles, fish, oysters, and general merchandise, and for the year ending June 30, 1909, is estimated at a valuation of $475,025.

With the work done a substantial reduction in ocean rates is expected, due to increased draft and improved facilities for lighterage, and a further reduction on freight handled by rail should result from the completion of the project for turning basin and 18-foot channel thereto, and the improvements projected by the Georgia, Florida and Alabama Railway Company in connection therewith.

It is proposed to apply the amount estimated as a profitable expenditure during the fiscal year ending June 30, 1911, to completing the 18-foot channel and turning basin, and in maintenance to keep the improvement available.

July 1, 1908, balance unexpended		$48,692.62
Allotment from emergency appropriation, act of March 2, 1907		9,861.35
Amount allotted from appropriation by river and harbor act approved March 3, 1909		15,000.00
		73,553.97
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$43,729.75	
For maintenance of improvement	24,624.94	
		68,354.69
July 1, 1909, balance unexpended		[a] 5,199.28
July 1, 1909, outstanding liabilities		2,466.51
July 1, 1909, balance available		2,732.77
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		[b] 35,000.00

CLEARWATER HARBOR AND BOCA CEIGA BAY.

Report on a recent survey is printed in House Document No. 1190, Sixtieth Congress, second session. The report of the Board of Engineers, in which the Chief of Engineers concurs, is as follows:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., November 30, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

In the within report the district officer presents a project for constructing an inside waterway 5 feet deep at mean low water and 75 feet wide from Clearwater Harbor to Blind Pass, in upper Boca Ceiga Bay, and thence 7 feet deep and 100 feet wide to Tampa Bay, the increased dimensions through the latter stretch being deemed advisable on account of the more exposed location of the channel. The cost of the work is estimated at $96,500, and for reasons stated the district officer believes that the locality is worthy of improvement by the United States to the extent covered by his estimate. In this opinion the division engineer does not concur.

The area to be served by this waterway is one of considerable commercial importance, though not of great population. The land is fertile and well adapted to the cultivation of semitropical fruits, of which a substantial tonnage is now shipped by rail. It is claimed that freight rates are exorbitant and the service unsatisfactory, considerable losses occuring through the failure of the railroad to handle freight offerings promptly.

Being impressed by the claims of local interests, but hesitating to recommend so large an expenditure as that required by the within-described project, the Board requested the district officer to submit an estimate of cost of a modified

[a] In addition to this balance the further sum of $15,000 is made available by the river and harbor act of March 3, 1909, but not yet allotted.

[b] The item of $20,000 for dredge construction may be omitted if the improvement of St. Andrews Bay, Fla., is not authorized.

plan, calculated to meet the needs of commerce as far as practicable by a moderate expenditure. The only change contemplated by this modified plan is a reduction of width from 75 to 50 feet from Clearwater Harbor to upper Boca Ceiga Bay, and the improvement as thus modified is estimated to cost $59,000, with an allowance of $3,000 annually for maintenance. The Board believes that this expenditure is justified by the benefits to be derived from the work, and recommends that the modified project be adopted, involving an expenditure of $59,000 for original work and $3,000 annually thereafter for maintenance.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

Owing largely to the lack of a suitably protected water route to Tampa, only about 3 per cent of the total trade of the neighborhood is carried by water. Citrus fruits and fish constitute the principal commerce of the locality, and it is stated that, on account of inadequate railroad facilities, considerable fruit has been lost and settlers thereby deterred from planting citrus fruit groves.

A partial estimate of the amount of fruit and vegetables shipped from the country along this waterway amounts to 400,000 boxes, or 320,000 hundredweight, and a saving of but 20 cents per hundred pounds would amount to $64,000 annually.

FERNANDINA HARBOR AND CUMBERLAND SOUND, FLORIDA.

In the last paragraph of report on Cumberland Sound is a recommendation that these be united under one head:

(*a*) *Fernandina Harbor, Florida.*—As will be seen from Coast Survey chart No. 453, the lower end of Amelia River forms a deep basin opposite the city of Fernandina, which portion of the river is known as Fernandina Harbor. The lower end of the harbor connects with Cumberland Sound and is 2 miles from the bar. The harbor is about 1,300 feet in width at the entrance and about 2 miles long. It embraces about 160 acres of well-sheltered anchorage ground, with a depth greater than 25 feet at mean low water, but is somewhat obstructed by small shoals. Above this basin there exists a shoal some 4,000 feet in length, with low-water depths over same ranging from 14 to 18 feet. Above this shoal the river separates into two estuaries, which carry deep water for about 2 miles.

A project providing for such extensions of the depth and width of the channel in front of the town of Fernandina as will meet the requirements of commerce will be found printed as House Document No. 388, Fifty-ninth Congress, first session.

The improvement proposed consists in dredging a channel with widths varying from 400 to 600 feet and depths from 20 to 24 feet at mean low water, in front of and to a short distance above (southwest of) the city of Fernandina. The estimated first cost of this work is $115,000, with $15,000 at periods of every two or three years for maintenance after completion.

This project was adopted by act of Congress approved March 2, 1907, which appropriated $115,000 for its completion.

Work under the project was begun September 14, 1907, and completed July 28, 1908. During the fiscal year a total of 46,341 cubic yards of material were removed under contract, completing the project. The engineer building at Old Town, Fernandina, was repaired.

On June 30, 1909, the controlling depths in the channel fronting the city of Fernandina were those contemplated in the adopted project. Very little shoaling has taken place since the project was completed. Soundings indicate some caving in the sides with the depth on the edges of the channel slightly diminished.

The mean rise and fall of the tide is 6 feet.

The amount expended up to June 30, 1909, was $109,398.09.

The project was completed July 28, 1908.

It is proposed to expend the available balance and additional appropriation recommended in maintaining the improvement.

The additional work proposed is for extension of benefits.

Attention is invited to the recommendation in the report on Cumberland Sound that that work and Fernandina Harbor be united under one title and be hereafter reported upon as one work.

Before the improvement of Cumberland Sound (in 1879) which constitutes the ocean entrance to Fernandina Harbor, the annual in and out bound tonnage at Fernandina was about 300,000, and the value of imports and exports estimated at about $2,500,000. The commerce of the port during the calendar year 1908 amounted to 550,000 tons, with a value of $9,274,000. The chief articles of export are lumber, phosphate rock, and naval stores.

The effect of the improvement of Cumberland Sound has been to cause a reduction in freight rates of from 25 to 40 per cent. It can not now be said what further effect the improvement of Fernandina Harbor will have upon these rates.

A map showing conditions June 30, 1908, will be found opposite page 1358, Annual Report of the Chief of Engineers for 1908.

July 1, 1908, balance unexpended	$29,907.02
June 30, 1909, amount expended during fiscal year, for works of improvement	24,305.11
July 1, 1909, balance unexpended	5,601.91
July 1, 1909, outstanding liabilities	50.00
July 1, 1909, balance available	5,551.91
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

(*b*) *Cumberland Sound, Georgia and Florida.*—In its original condition the available depth of the entrance varied from 11 to 12.5 feet at mean low water. The point of crossing the bar was subject to very great changes in location, moving in a series of years as much as 1½ miles. The distance from the outer bar to the city of Fernandina, Fla., is about 6½ miles.

The project of improvement submitted in 1879 and revised by a Board of Engineers in 1891 provides for the construction of two low jetties from the shores on opposite sides of the entrance and extending seaward across the bar upon lines so directed that the ends will be parallel to each other and about 3,900 feet apart. These jetties were intended to establish a low-water channel across the bar not less than 19 feet in depth. The cost of the improvement was originally estimated at $2,071,023, and as modified at $1,606,500, for the completion of low jetties, and at $2,079,500 if high jetties were found necessary. There was expended under this project $932,500.

The present project, which was adopted by act of Congress of June 3, 1896, provides for the establishment of a channel across the bar 19 feet deep at mean low water by the construction of two jetties of stone, resting on a foundation of brush mattresses, on the same line as those in the previous project, the scour between the jetties to be aided by dredging, if necessary, the total cost of the improvement, at the time of this project, to be $2,350,000, exclusive of amounts previously appropriated.

The amount expended under this project up to June 30, 1909, was $2,439,947.53 (of which $340,063.13 was for maintenance), which, added to the amount previously expended, gives a total expenditure for this work of $3,372,447.53.

A total of $8.90 received from sale of unserviceable property has been received and deposited to the credit of the appropriation.

By this expenditure two stone jetties have been constructed and a seagoing dredge provided, which together have produced a navigable channel with a minimum width of 400 feet and a controlling depth of 24.5 feet at mean low water, or 5.5 feet more than called for by the project.

All work done during the fiscal year was for maintenance and consisted of the raising and repairing of the south jetty, between stations 8800 and 11350, by the placing of a total of 29,697.57 tons of stone. The jetty between these stations was raised so that its crest was brought up to mean high water. The outer end of the jetty was aproned for about 350 feet with small stone, and this aproning was extended for about 100 feet beyond the outer end of the completed work. A survey of the entrance to Cumberland Sound was made and the results plotted.

The present ship channel, as marked by the ranges, has a controlling depth of 24 feet at mean low water, because of a slight advance of the lower point of Pelican shoal, but by slightly changing the courses run 2 or 3 feet could easily be added to the navigable depth.

The mean rise and fall of tide is 6 feet.

The project for the improvement of Cumberland Sound was reported as completed in the Annual Report of the Chief of Engineers for 1905, page 1287.

It is proposed to apply the available balance and additional appropriation recommended toward raising the low places in the north and south jetties to high-water mark, filling voids and openings in the north jetty, and constructing mounds at the outer ends of both jetties, and for such repairs to the dike on Cumberland Island and such dredging in the jetty channel as may become necessary.

The additional work proposed is for extension of benefits.

As Cumberland Sound merely constitutes the ocean entrance to Fernandina Harbor the commerce is practically the same as that for Fernandina, and since the harbor of Fernandina is now a special work of improvement the commerce is given under that head.

The effect of the improvement has been to cause a reduction in freight rates of from 25 to 40 per cent.

This work has heretofore been mentioned in the law as "Cumberland Sound," but the sole object of the improvement is to afford a deep entrance to the harbor of Fernandina, Fla., and this is what it

accomplishes. An appropriation has been made for the improvement of the harbor of Fernandina, and had reference only to the inner portion of the same. It would be better hereafter to unite these two works under one head and refer to them as Fernandina Harbor, Florida.

July 1, 1908, balance unexpended	$100,930.14
Amount allotted from appropriation by river and harbor act approved March 3, 1909	20,000.00
	120,930.14
June 30, 1909, amount expended during fiscal year for maintenance of improvement	85,868.77
July 1, 1909, balance unexpended	35,061.37
July 1, 1909, outstanding liabilities	148.33
July 1, 1909, balance available	34,913.04
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	50,000.00

HILLSBORO BAY, FLORIDA.

Report on a recent survey is printed in House Document No. 634, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, January 29, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated March 31 and November 22, 1909, with maps, by Capt. Geo. R. Spalding, Corps of Engineers, on preliminary examination and survey, respectively, called for by the river and harbor act approved March 3, 1909, of Hillsboro Bay, Florida, from the 24-foot contour in the bay through the present 20-foot channel to the head of the estuary in the direction of Ybor City, thence from the mouth of said estuary through said bay, as near the eastern shore thereof as practicable, to the western end of Hookers Point, and thence through the channel recently constructed by the Tampa Northern Railway Company to said 20-foot channel.

Under a project completed in 1908 there was obtained a channel 20 feet deep at mean low water and 150 feet wide from the lower bay to the mouth of Hillsboro River, with a turning basin at inner end 450 feet wide and 1,050 feet long.

The district officer submits plans for a channel 200 feet wide and 24 feet deep from Tampa Bay along the line of the present 20-foot channel to the turning basin, thence easterly 300 feet wide and 24 feet deep to the mouth of and up the estuary to Ybor City, and from the mouth of the estuary through the present Tampa Northern channel to the main channel, involving dredging and rock removal, at an estimated cost of $1,750,000, with an annual cost of maintenance of $20.000 for five years after completion; after that it is believed that $10.000 annually will be sufficient for maintenance. He considers the locality worthy of improvement as proposed, and this opinion is concurred in by the division engineer, who believes, however, that a portion of the expense should be borne by local interests.

These reports were referred to the Board of Engineers for Rivers and Harbors for consideration, and in accordance with its recommendation the district officer submitted an estimate for a less extensive plan providing for a channel 24 feet deep and 200 feet wide through the present 20-foot channel to the turning basin, and thence easterly 300 feet wide through the Seaboard Air Line Railway bridge to a suitable turning basin approximately at the entrance to the estuary at an estimated cost of $1,054,500, and $10,000 annually after completion for maintenance. The Board considers the locality worthy of improvement to this extent and recommends the modified plan for adoption.

I concur with the district officer in the opinion that this locality is worthy of improvement in accordance with the larger project at an estimated cost of $1,750,000, and $20,000 annually for five years afer completion for maintenance, and after that $10.000 annually for maintenance, for the reason that the lesser project does not provide for sufficient facilities for use by the public upon equal terms.

However, my recommendation of the larger project is conditioned as follows:

That no expenditure be made on that part of the harbor between the new turning basin and Ybor City until the Secretary of War is assured that the local municipality will construct wharves or slips having an available length not less than 1,400 feet which shall be open for the use of the general public under reasonable regulations and charges, and also that the municipality has obtained such control of the property for at least 700 feet on each side of the proposed Ybor channel throughout its length as will insure its use primarily in the interest of general commerce, on equal terms to all; and that all wharfage charges and regulations shall be reasonable and fully controlled by the municipal authorities and subject to the approval of the Secretary of War.

The work considered of greatest importance and first to be executed is that recommended by the Board, the removal of the southern end of Seddon Island and the extension of the channel toward Sparkman Bay approximately 1,000 feet; next, the channel toward Ybor City; and of least importance the connecting channel through Sparkman Bay.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

THE SECRETARY OF WAR.

Within a very short time after the completion of the 20-foot channel the Mallory Steamship Company made Tampa a port of entry. During the latter half of the calendar year 1908 over 48,000 tons were transported by this line alone, and the company soon requested additional wharfage room and doubled their service at Tampa, which now consists of four large steamers, giving a weekly service each way between New York and Mobile.

The entrance of the Bee Line of schooners has done much to increase the commerce at this port. During six weeks, from the time of the first trip in November until the end of the year, 12,000 tons of lumber and steel rails were transported.

The total tonnage of this port for the year ending December 31, 1908, was 560,170 tons, as compared with 520,629 tons for 1907. This increase was mainly due to the entrance of the Mallory and Bee lines to this port and is encouraging, in view of the depression existing throughout the country during 1908, and as the increase is based on the commerce of the latter part of the year the prospects for the present year are exceptionally bright. During the past year the Dowling Lumber and Export Company alone shipped by water more lumber than the total entire shipments of the previous year.

There are about 20 independent sawmills in the surrounding country making efforts to secure, through the secretary of the board of trade, wharfage room for the storage of lumber, which room is not now available. The large wholesale houses of Tampa are anxious to secure more wharfage room for the receiving of cargoes without paying high terminal charges, which they are now forced to do.

The two railroads having new terminals adjacent to the 20-foot channel feel the necessity for securing a 24-foot channel to accommodate the ships which they are preparing to receive, while the local shippers demand, in addition, that this channel be extended along the water front.

HARBOR AT PENSACOLA, FLA.

The available depth across the inner bar at the entrance to this harbor in 1879, previous to any work of improvement, was 19.5 feet, the width of the channel being contracted by the encroachment of the Middle Ground shoal to the southward. The harbor entrance and channel way were also obstructed by wrecks, and the western shore line in the vicinity of Fort McRee was cutting away rapidly, almost the whole of the old Fort McRee washing away before the erosion was stopped.

The project of 1877 considered only the removal of the wrecks; that of 1878 called for the removal of these wrecks and for making a survey to determine further recommendations for improvement. The project of 1881 provided for dredging a channel 300 feet wide and 24 feet deep at mean low water for the temporary relief of navigation, and also for protecting the shore line near Fort McRee, with a view to preventing further injurious changes. Dredging under this project was carried on at various times between 1881 and 1893, and at the close of the dredging operations in August, 1893, the available channel was 225 feet wide and 24 feet deep at mean low water. Two groins, one 360 feet and the other 220 feet long, were completed in 1890 and still serve to hold the shore line near Fort McRee.

In 1891 a special Board of Engineers presented a project for opening a new channel across the Caucus shoal, following the direction of the ebb current, by means of two jetties, assisted by dredging, if necessary. In 1895 a second special Board of Engineers recommended that no change be made in the project of 1891, but that dredging be tried, using one of the hydraulic dredges belonging to the United States to open up a channel 26 feet deep at mean low water and as wide as practicable on the line of deepest water across the Caucus shoal and approximately on the line of the axis of the jettied channel proposed by the Board of Engineers in 1891. In December, 1895, this channel was opened by the U. S. dredge *Gedney* to a width of 120 feet and depth of 24 feet at mean low water. It has a length of about 10,000 feet across Caucus shoal and is now known as the Caucus channel.

In 1896 the same Board that recommended the first amendment to the project of 1891 submitted a second amendment providing for the expenditure of all funds available in continuing the work of dredging across the Caucus shoal and for building a dredge and opening the channel across the Caucus shoal 30 feet deep at mean low water to a width of at least 300 feet, with such side slopes as the material would assume, if sufficient funds were made available by Congress. Until a channel should be opened by dredging across the Caucus shoal, as above proposed, the Board recommended that the construction of the jetties for its maintenance be not considered.

The river and harbor act of March 3, 1899, extended this project to "securing a channel depth of 30 feet at mean low water, from the Gulf of Mexico to the dock line at the east end of the city of Pensacola."

The amount expended on these projects to June 30, 1905, was $725,956.94. The work done comprises the removal of the wrecks obstructing the channel, dredging a large amount of material from

the inner bar, opening and redredging a 30-foot channel across the Caucus shoal, and the protection of the shore line from erosion by the construction of two groins near old Fort McRee.

The river and harbor act approved June 13, 1902, appropriated $220,000, of which $150,000 might be used in constructing a seagoing suction dredge. This dredge, the *Caucus*, was built and turned over to the district in August, 1905. The same act modified the project, which now provides for dredging a channel 30 feet deep and 500 feet wide from the Gulf of Mexico to the dock line at the east end of the city of Pensacola. There is no approved estimate of the cost of this project. Under this amended project there has been expended for dredge construction $172,221.27 and for the improvement $259,995.39, of which about $175,000 has been applied to maintenance.

The project is about 33 per cent completed.

The dredge *Caucus* commenced dredging September 18, 1905, and at the close of the present fiscal year had removed a total of 2,039,138 cubic yards of material. This work has restored the channel to its original dimensions and widened it, and removed the shoaling due to the storm of September, 1906, so that on June 30, 1909, the minimum width of channel having a depth not less than 30 feet at mean low water was approximately 300 feet.

From July 1, 1908, to October 11, 1908, the *Caucus* continued dredging. On October 11 she was docked at the Pensacola Navy-Yard for annual repairs. Owing to lack of funds she was sent to Carrabelle, Fla., after repairs were completed, returning to Pensacola June 1, 1909, since which time she has been at work with one pump, on account of pump shaft being broken.

The maximum draft that could be carried over the improvement at mean low water on June 30, 1909, was 30 feet, and the ordinary range of the tide is about 1.1 feet.

The commerce of this port is very large. For the fiscal year ending June 30, 1903, the foreign exports were reported as $13,741,540, no record of the coastwise exports being available; in 1904, as $15,893,456; in 1905, exports as $15,295,067, and imports as $985,840; in 1906, exports as $18,432,931, and imports as $386,377; in 1907, exports as $20,229,414, and imports as $618,363; in 1908, exports as $20,322,649, and imports as $675,503; in 1909, exports as $16,306,056, and imports as $1,188,925.

The completion of the project will give greatly increased facilities to the large commerce of Pensacola, but will not materially affect freight rates.

It is proposed to apply the appropriation recommended in dredging operations toward completion of the project and maintenance of the project depth.

July 1, 1908, balance unexpended		$38,333.11
Amount allotted from appropriation by river and harbor act appoved March 3, 1909		110,000.00
		148,333.11
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$10,000.00	
For maintenance of improvement	25,971.24	
		35,971.24

July 1, 1909, balance unexpended	$112,361.87
July 1, 1909, outstanding liabilities	3,121.54
July 1, 1909, balance available	110,240.33
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	90,000.00

ST. ANDREWS BAY, FLORIDA.

The following is from House Document No. 12, Sixty-first Congress, first session:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, April 6, 1909.

SIR: I have the honor to submit herewith for transmission to Congress reports, with maps, by Capt. H. B. Ferguson, Corps of Engineers, dated November 15, 1907, October 10, 1908, November 5, 1908, and March 1, 1909, on preliminary examination and survey of St. Andrews Bay, Florida, authorized by the river and harbor act approved March 2, 1907.

St. Andrews Bay, on the west coast of Florida about 110 miles southeast of Pensacola, has twice before this been examined with a view to improvement, once under authority of the river and harbor act of August 11, 1888, and again under the act of June 13, 1902; but to the present time no work has been undertaken by the United States. The existing traffic is small and the commercial interests are largely prospective.

In the course of the present investigation careful consideration has been given to different degrees and various plans of improvement. In his survey report of October 10, 1908, Captain Ferguson recommends dredging a channel through East Pass and Camels Back shoal, within the bay, to secure a depth of 26 feet and width of 300 feet, at an estimated cost of $326,264 and $20,000 a year for maintenance after completion. In his opinion St. Andrews Bay is worthy of improvement to the extent recommended.

From the facts and for the reasons given the division engineer, Lieut. Col. L. H. Beach, Corps of Engineers, states in his report of October 15, 1908 (also herewith), that it appears to him inadvisable to undertake the improvement at this time.

The matter has been referred, as required by law, for consideration by the Board of Engineers for Rivers and Harbors, and attention is especially invited to the Board's accompanying report of March 15, 1909. In conclusion the Board expresses the belief that a less expensive improvement than that indicated above will serve to test the commercial value of a harbor at this place and determine the stability of a channel located on the lines proposed by the local officer. The Board accordingly recommends the adoption of a project providing for a channel 22 feet deep and 200 feet wide through East Pass into St. Andrews Bay, at an estimated cost of $203,560 for original improvement and $20,000 per annum thereafter for maintenance. This estimate for original work includes $100,000 for a suitable dredging outfit to be owned and operated by the General Government.

I concur in the views and recommendations of the Board of Engineers for Rivers and Harbors.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

The following is an extract from the report of the division engineer:

For consideration of the present and prospective commerce of this locality, reference is made to report on preliminary examination submitted under date of November 15, 1907. Since the date of that report the railroad from Dothan, Ala., to St. Andrews Bay has been completed. The railroad from Chipley, Fla., is completed for 18 miles. The grading is completed for 30 miles.

The present actual commerce of this harbor is about $740,000. The commerce is lumber, turpentine, and rosin.

Due to the completion of the railroad from Dothan, the immediately prospective commerce of this harbor, when improved, will be about 100,000 bales of cotton, valued at about $6,000,000. The freight on the portion of this commerce that is not actually carried through this harbor will be affected. The saving in freight on the present actual commerce will be about $75,000. The saving in freight on this immediately prospective commerce will be over $100,000.

The eventual commerce of a harbor at this place must consider the total value of export products in all the tributary territory. Though eventually a greater part of this commerce will probably be carried to St. Andrews by rail, it is deemed proper to consider the fact that the Government can, by digging a short canal from East Arm of St. Andrews Bay to the Apalachicola River, insure that this commerce reach St. Andrews Bay by the Apalachicola River system and this canal, which river system and canal will insure equitable rates even after they are paralleled by railroads. The present actual commerce on the Apalachicola River system is about $10,000,000 per year. This river now having no export harbor is, commercially, simply a long lake. The immediately prospective or affected commerce per year after the completion of such a canal and improvement of this harbor may be taken as $23,000,000, and the total saving in freight as $230,000. It is economically possible to bring to this harbor with this canal $38,000,000 of commerce. This last condition, it is believed, will maintain after the completion of the Isthmian Canal.

CHANNEL FROM APALACHICOLA RIVER TO ST. ANDREWS BAY, FLORIDA.

The following report of the Board of Engineers on a recent survey, in which the Chief of Engineers concurs, is printed in House Document No. 670, Sixty-first Congress, second session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., February 1, 1910.

Respectfully returned to the Chief of Engineers, U. S. Army.

In the within report the district officer submits estimates of cost for constructing a waterway between Apalachicola River and St. Andrews Bay, via three routes. For reasons stated he advocates selection of the Lake Wimico-Searcy Creek-South Prong Wetappo Creek route, and recommends the excavation of a channel 7 feet deep and 75 feet bottom width, at an estimated cost of $614,700. The annual cost of maintenance is estimated at $10,000.

Having in mind the value and importance of the growing commerce of the Apalachicola River system and the benefits which the proposed waterway will bestow by affording communication with a deep-water harbor, the Board has reached the conclusion that it is advisable for the United States to undertake the construction of a waterway connecting this river with St. Andrews Bay by way of the route favored by the district officer. After study of the question of suitable cross section for such a waterway, in connection with which the Board has had the benefit of the views of interested persons from the locality, it seems clear to the Board that for the transportation of the commerce of the Apalachicola River system, which is now carried in vessels of from 2 to 4 feet draft, a depth of 5 feet in the proposed waterway will be sufficient for present needs. A suitable width for a channel of this depth is believed to be 65 feet. At the request of the Board, the district officer has submitted in a separate communication an estimate of cost, in the sum of $450,000 for constructing a waterway 5 feet deep and 65 feet bottom width. The Board believes that the cost of this work is reasonable and that the locality is worthy of improvement to this extent.

The route recommended is understood to be identical with a part of that proposed for an intercoastal waterway from St. Georges Sound to the Rio Grande River. Should the proposed intercoastal waterway be adopted, and

should it provide a greater depth and width than that mentioned above, the channel herein recommended would merely require enlargement to adapt it for service as a part thereof.

As the realization of the fullest benefits from the waterway between Apalachicola River and St. Andrews Bay is dependent upon the existence of a suitable harbor at St. Andrews Bay, the Board deems it proper to invite attention to House Document No. 12, Sixty-first Congress, first session, in which may be found the views and recommendations of the Board in reference to the construction of a harbor at that place.

The district officer described existing wharves and terminal facilities, and attention is respectfully invited to his remarks on this subject. In compliance with the provisions of section 13 of the act of March 3, 1909, the Board reports that there are no questions of waterpower or other subjects so related to the project proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures made in the interests of navigation.

For the Board:

WM. T. ROSSELL,
Colonel, Corps of Engineers,
Senior Member of the Board.

SARASOTA BAY, FLORIDA.

Before improvement there was a navigable channel in Sarasota Bay with least depth of 5 feet at mean low water, except at two shoals, where the depths were 4.3 and 3.5 feet, respectively. Little Sarasota Bay had a channel with a least depth of 1.2 feet at mean low water, except at one shoal which was bare at low water.

The project, adopted in 1889, provides for a channel 100 feet wide and 5 feet deep at mean low water from Tampa Bay to Sarasota at an estimated cost of $17,500.

The sum of $10,000 had been expended under this project when it was modified (in 1896) to include a channel 75 feet wide and 3 feet deep in Little Sarasota Bay from Sarasota to Caseys Pass. The estimated cost of completion of the entire project was $45,000, making a total estimate of $55,000, subsequently increased to $70,000.

The river and harbor act of March 2, 1907, provided for continuing improvement from Tampa Bay to Venice. Venice is about 2 miles southeasterly from Caseys Pass.

The total expenditure to June 30, 1909, was $58,035.25, of which $13,077.18 was for work of maintenance.

The project, as modified by the river and harbor act of March 2, 1907, is about 61 per cent completed.

As a result there is a channel 50 feet wide and 5 feet deep at mean low water from Tampa Bay to Sarasota. From Sarasota to Caseys Pass the channel is 3 feet deep at mean low water, and varying in width from 50 to 75 feet.

The maximum draft that could be carried on June 30, 1909, was 5 feet to Sarasota, and thence to Caseys Pass, 2 feet. Mean rise and fall of tide is 1.5 feet.

The length of the 5-foot channel from Tampa Bay to Sarasota is 20 miles, and the 3-foot channel from Sarasota to Venice is 18 miles.

Venice is the extreme southerly point of the channel and may be given as the head of navigation in fact.

During the winter season, when by far the largest shipments are made, the prevailing winds decrease the mean level of the water in the bay by over a foot. This fact would indicate the desirability of

a revision of the project with a view to securing a greater depth with, if necessary, a reduction in width. The river and harbor act of March 3, 1909, provided for a survey of this waterway with a view to securing a revision.

The amount estimated as a profitable expenditure during the fiscal year ending June 30, 1911, includes $10,000 for maintenance, which is necessary to keep this improvement available, and $25,000 which is necessary to complete the project by widening, thus extending present benefits.

The commerce of Sarasota Bay is in naval stores, fruits, vegetables, fertilizers, fish, lumber, and general merchandise. The value of commerce for the calendar year 1908 was $1,300,000.

Tonnage by years: 1899, 9,424; 1902, 4,313; 1903, 4,755; 1904, 25,479; 1905, 8,556; 1906, 12,010; 1907, 13,350; 1908, 54,700.5.

The freight rates have been lowered 25 to 50 per cent, depending on freight classification, since the improvement was undertaken.

July 1, 1908, balance unexpended	$7.50
November 2, 1908, allotted from emergency appropriation, act March 2, 1907	3,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	8,007.50
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	3,000.00
July 1, 1909, balance unexpended	5,007.50
Amount (estimated) required for completion of existing project	25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	35,000.00

TAMPA BAY, FLORIDA.

Before improvement the least depth between the Gulf of Mexico and Port Tampa was 13 feet.

The first project, adopted August 11, 1888, contemplated a channel 200 feet wide and 20 feet deep at mean low water from Tampa Bay to Old Tampa Bay. The estimated cost was $63,000. Prior to this work was carried on in connection with improvement of Hillsboro Bay.

The total expenditure under all these projects was $130,000.

The present project was adopted March 3, 1899. It provided for a channel 27 feet deep at mean low water from the Gulf of Mexico to Port Tampa, 500 feet wide across the bar and 300 feet wide in the bay, a channel of full width and 24 feet deep to be first secured, and subsequently deepened. The estimated cost was $750,000.

This project was modified March 3, 1905, by Congress authorizing the Secretary of War to expend the balance remaining to the credit of this improvement in securing a channel 26 feet deep with sufficient width and by providing that no expenditure should be made until the owners of the terminals at Tampa Bay should by valid contract agree that the wharfage charges at such terminals should be submitted for approval to the Secretary of War. A schedule of such charges was approved by the Secretary of War on October 26, 1906.

The amount expended under this project, as revised, to June 30, 1909, was $607,460.81, including contingent expenses and completion of the United States dredge *Key West.*

It is proposed to expend the amount estimated as a profitable expenditure for fiscal year ending June 30, 1911, in dredging for maintenance to keep the improvement available.

Operations during the year consisted in dredging under contract and by government plant in prosecution of the project, which is 80 per cent completed.

The maximum draft that can be carried at mean low water is 24½ feet. Mean rise and fall of tide at Tampa Bay entrance is 1.5 feet and at Port Tampa 2 feet.

The head of navigation for 24½-foot draft is Port Tampa, 35 miles from deep water in the Gulf of Mexico. Tampa Bay is navigable in fact over its entire area.

The commerce is in phosphate, lumber, coal, crude petroleum, tobacco, grain, and general merchandise. The value of the commerce for the year 1908 was $14,821,838.68.

Tonnage by years: 1896, 276,638; 1898, 236,136; 1899, 238,305; 1900, 350,761; 1901, 416,503; 1902, 462,703; 1903, 435,867; 1904, 591,181; 1905, 604,131; 1906, 838,378; 1907, 885,202; 1908, 1,314,104.

The freight rates have been lowered 20 per cent on phosphate shipments since the improvement was undertaken.

July 1, 1908, balance unexpended	$93,659.21
Amount allotted from appropriation by river and harbor act approved March 3, 1909	20,000.00
	113,659.21
June 30, 1909, amount expended during fiscal year for works of improvement	91,095.56
July 1, 1909, balance unexpended	22,563.65
July 1, 1909, outstanding liabilities	1,700.000
July 1, 1909, balance available	20,863.65
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	18,000.00

ANCLOTE RIVER, FLORIDA.

See report on Crystal, Anclote, and Suwanee rivers.

APALACHICOLA RIVER, FLORIDA, INCLUDING THE CUT-OFF AND LOWER CHIPOLA RIVER, FLORIDA, AND THE UPPER CHIPOLA RIVER FROM MARIANNA TO ITS MOUTH.

(*a*) *Apalachicola River, the Cut-off, and Lower Chipola River.*—From the junction of the Chattahoochee and Flint rivers to the Gulf of Mexico (Apalachicola Bay) the Apalachicola River has a length of about 137 miles and a low-water slope of about 3 inches to the mile. The width varies from 150 to 300 yards and the available depth was originally 6 feet at low water, except where obstructed by snags and sunken logs.

The confederate authorities obstructed the channel at a point about 47 miles above the mouth, causing the river to break through

by a channel known as Moccasin Slough into the River Styx, the latter a tributary entering the Apalachicola a few miles below the confederate obstructions. Moccasin Slough was very narrow and tortuous and much obstructed by logs, snags, etc., and the former channel has gradually filled up.

About 55 miles above the mouth steamboats may leave the river and, after passing through the Cut-off, Lower Chipola River, and Lee Slough, reenter it about 17 miles farther down, thus making many landings of much greater importance than those upon the corresponding part of the main river, which includes Moccasin Slough, above mentioned.

The original project adopted by the act of June 23, 1874, contemplated securing a channel 100 feet wide and 6 feet deep at low water by the removal of snags and overhanging trees and widening and straightening Moccasin Slough and the Elbows, at an estimated cost of $80,333.

The act of September 19, 1890, adopted an addition to the project, providing for the clearing of a channel 60 feet wide and 5 feet deep through the Cut-off, Lee Slough, and the Lower Chipola River, at a cost of $7,500.

The amount expended on work under this project since 1874 to the close of the fiscal year ending June 30, 1909, was $106,485.72. In addition there was expended between 1828 and 1831, $13,000, for which no project is of record. These expenditures have improved Moccasin Slough sufficiently for present purposes and maintained the river reasonably free from snags and other obstructions and enabled steamboats to make use of the Cut-off, Lower Chipola River, and Lee Slough either by day or night. An available depth of 6 feet has been secured in the Apalachicola River and 5 feet in the Cut-off, Lower Chipola River, and Lee Slough. The Cut-off and Lee Slough have been widened also at the narrowest places so that steamboats can pass through readily going downstream and can pass upstream with little difficulty, but the channel in Lee Slough is still very crooked, with some sharp bends that require easing, and the steamboats prefer the main river on the up trip. It is estimated that the project is about 85 per cent completed.

The work was done with the plant belonging to the Chattahoochee and Flint river improvements, and comprised cutting overhanging timber, removing snags and logs, blasting out cypress stumps, and widening the slough and Cut-off by clearing the points of timber and dredging them off, depositing the dredged material in the deep holes or upon the banks.

During the fiscal year work has been confined to the maintenance of the improvement and a small amount of permanent work in the Cut-off and Lee Slough.

Variation of the water level is from 0 to 30 feet at Chattahoochee River bridge.

This river is navigable throughout its entire length of 137 miles.

As the country bordering on the Apalachicola River is largely dependent upon the river for the transportation of its supplies and products, this improvement is essential to the development of this section, but in the absence of any basis of comparison the effect upon freight rates can not be determined.

It is proposed to apply the available balance and the funds recommended to maintenance of Apalachicola River proper by removing annual accumulation of snags, and to continue straightening and widening the Cut-off as above to make the improvement available.

The commerce of the river consists chiefly of cotton, naval stores, general merchandise, saw logs, and timber for export, and is so combined with that of the Chattahoochee, Flint, and Upper Chipola rivers that a separation is impossible. The commerce of all these streams has increased from about $4,000,000 in 1899 to about $12,000,000 in 1909. For detailed statistics see report on Flint River improvement.

For reference to reports of examinations of this river see Report of the Chief of Engineers for 1906, page 337.

(*b*) *Upper Chipola River, Florida, from Marianna to its mouth.*—The river from Marianna to the head of the Dead Lakes has a general low-water depth of 5 feet and width varying from 60 to 200 feet, but is greatly obstructed by rock shoals, snags, and overhanging trees. Three bridges also form obstructions, their headways above low water being 17, 16, and 15 feet, respectively.

At Look and Tremble shoal, about 45 miles above the Dead Lakes, there is a fall of 5 feet in 40 over rock bottom. At Sister Islands, between this shoal and the Dead Lakes, the main channel of the river is very tortuous and obstructed by mud bars, over which there is less than 2 feet at low water. The channel through the Dead Lakes, which is considered part of this improvement, has plenty of water, but was obstructed by snags and large cypress stumps and trees.

The approved project, adopted by act of March 3, 1899, provides for clearing a low-water channel 3 feet deep and 60 feet wide from Marianna to the foot of the Dead Lakes, estimated to cost $41,000, exclusive of necessary plant, which would comprise a snagboat, drilling barge, and dump scow.

The amount expended to June 30, 1909, was $20,000. In 1904 $5,000 was applied to the river above Sister Islands. Snags, logs, and overhanging trees were removed, and a channel blasted through the rock reefs from Marianna to Look and Tremble shoal; wing dams were built below some of the shoals, and below Look and Tremble shoal, down as far as Sister Islands, snags, logs, and overhanging timber were removed, as well as available funds permitted. From the lower end of the Dead Lakes for a distance of 35 miles a channel 60 feet wide was cleared of obstructions by removing logs, overhanging trees, cypress stumps and knees. During the year snagging was done from the Dead Lakes to Look and Tremble shoal. Very little benefit has been derived from the expenditure above Look and Tremble shoal, except to timber industry, but the work done below the shoal and in the Dead Lakes has been of great benefit, as there are many turpentine stills below this shoal, giving a considerable commerce on this portion of the river, and in the Dead Lakes a large commerce in towing logs.

The variation of the water level is 0 to 14 feet.

Two feet is the maximum depth at low water over the shoalest part of the river below the shoal Look and Tremble. The actual head of navigation at ordinary low water is Braxton's landing, 40 miles above the foot of the Dead Lakes. The river is in fair condition to Look and Tremble shoal.

About 50 per cent of the project is completed.

The commerce of this stream consists principally of naval stores, round and square timber, lumber, and other miscellaneous freights, the value of which is included in the combined commerce reported under Flint River improvement.

The section of country below Look and Tremble shoal has no railroads, and depends largely upon this river, the reduction in freight rates being the lessened haul to river as compared to Apalachicola River or railroads to the north and west.

It is proposed to apply the available balance and the funds recommended to dredging and regulation of channel at Sister Islands bar and to removal of snags and overhanging trees in remainder of river. This work is necessary to make the improvement available.

The territory through which the stream flows is heavily timbered with longleaf yellow pine and cypress, which is now being rafted down this stream in large quantities. The total amount of this traffic is reported as approximately 10,000,000 feet b. m. per annum, and is included in the valuation of timber and lumber exports for Apalachicola Bay and Carrabelle, Fla.

For reference to report of examination of this stream, see Report of the Chief of Engineers for 1906, page 338.

LOWER CHIPOLA RIVER.

Amount (estimated) required for completion of existing project	$3,000.00

UPPER CHIPOLA RIVER.

Amount (estimated) required for completion of existing project	30,000.00

CONSOLIDATED.

July 1, 1908, balance unexpended		9,832.42
Amount allotted from appropriation by river and harbor act approved March 3, 1909		13,000.00
		22,832.42
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$2,000.00	
For maintenance of improvement	11,568.14	
		13,568.14
July 1, 1909, balance unexpended		9,264.28
Amount (estimated) required for completion of existing project		33,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1900		10,000.00

BLACKWATER RIVER, FLORIDA.

The original project for this improvement was adopted March 3, 1899, and provided for securing a channel 9 feet deep from Milton, Fla., to Pensacola, Fla., at an estimated cost of $20,000. Under this project $5,000 was expended, and a channel of the required depth secured in the river proper.

The river and harbor act of March 3, 1905, fixed the width of the channel at 100 feet and the estimated cost of completion at $15,000.

With funds appropriated by this act an 8-inch suction dredge and other plant necessary for doing the work were repaired and dredging was commenced in East Bay near the beacon, about 2 miles below Robinsons Point, and a channel about 80 feet wide and not less than 9 feet deep was dredged for a distance of 4,470 feet toward Robinsons Point. This cut has improved the worst part of the channel and increased the available depth over the improvement about 1 foot, and it is estimated that the approved project is about 40 per cent completed. In the execution of this work it has been found that the area to be dredged over is much larger than indicated by the available charts of the improvement, possibly due in part to fill which has taken place since the surveys for the charts were made. To secure a channel 9 feet deep and 100 feet wide over the remaining shoals within the wide limits covered by the improvement is estimated to require $20,000 in addition to funds available. It is to be noted that in the report upon which the present project is based the doubtful character of the original estimate was recognized and the possibility of a considerable increase was clearly foreseen.

The total amount expended on this improvement up to the close of the fiscal year ending June 30, 1909, was $19,733.32, of which about $5,000 was for maintenance. The expenditure during the year was in payment of outstanding liabilities of the preceding year and incidental expenses.

The maximum draft that could be carried over the improvement at mean low water on June 30, 1909, was 8 feet. The usual variation of water surface is 2 feet. The head of navigation is at Milton, about 4 miles above the mouth of the river proper.

The effect of the improvement on freight rates, if any, can not be stated.

It is proposed to apply the additional appropriation recommended to completion of the project and its maintenance thereafter.

The commerce of this stream consists of timber, lumber, naval stores, and general merchandise, having an estimated value of $2,076,000 per annum. The dry dock at Bagdad and marine railway at Milton both do a large business, which would be materially increased by the completion of the project. Lumber brought by rail is stored in the bayou near Milton and taken to Pensacola via this river.

For reference to report of examination of this improvement, see Annual Report of the Chief of Engineers for 1906, page 345.

July 1, 1908, balance unexpended	$270.03
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	3.35
July 1, 1909, balance unexpended	266.68
July 1, 1909, outstanding liabilities	31.82
July 1, 1909, balance available	234.86
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	25,000.00

CALOOSAHATCHEE RIVER, FLORIDA.

The following is printed in Rivers and Harbors Committee Document No. 8, Sixty-first Congress, second session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., January 11, 1909.

SIR: 1. The Board of Engineers for Rivers and Harbors has the honor to submit its report in compliance with the following resolution of the Committee on Rivers and Harbors of the House of Representatives:

"*Resolved*, That the Board of Engineers for Rivers and Harbors be, and is hereby requested to examine and review the report made on the preliminary survey of the Caloosahatchee River, Florida, with special reference to that part of the river between Fort Myers and the mouth, and report whether said river or any part thereof is worthy of improvement."

2. The report referred to in the resolution is one submitted by the district officer on a preliminary examination of "Caloosahatchee River, from Lake Okechobee to the Gulf, including Orange River," ordered by the act of March 2, 1907. The improvement desired by local interests between Fort Myers and the mouth was the straightening and deepening of the channel. In his report the district officer stated that he could see no reason for recommending a greater depth than 7 feet, as contemplated by the existing project, but that some straightening of the channel near the mouth might be advisable. For reasons stated in its report of November 25, 1907, the findings of the Board were adverse to an enlargement of the project at this locality.

3. Desiring to acquire a more intimate knowledge of local conditions, the Board, through a committee, made an inspection of the river and held a public hearing at Fort Myers on September 17, 1908, and from the information thus secured concerning the commercial and navigation conditions, and the agricultural development of the locality, the Board arrived at the conclusion that the interests involved were sufficient to warrant a survey and estimate of cost, which it recommended. It requested that the district officer include in his report on the survey, estimates for channels 10 and 12 feet in depth, and also an estimate for completing the existing 7-foot project with such rectification as was deemed necessary. The survey has been made and estimates submitted as follows:

For completion of present 7-foot project from Fort Myers to the mouth of the river, with certain rectification of alignment	$35,000
The district officer believes this channel will be self-maintaining.	
For a channel 10 feet deep and 200 feet wide across the bar at the mouth of the river, and 10 feet deep and 100 feet wide thence to Fort Myers, including a turning basin	$110,000
Annual maintenance	2,000
For a channel 200 feet wide and 12 feet deep across the bar at the mouth of the river, and 100 feet wide and 12 feet deep thence to Fort Myers	214,000
Annual maintenance	2,000
For a channel 12 feet deep across the bar and 7 feet deep to Fort Myers	101,000
For a channel 12 feet deep across the bar and 10 feet deep to Fort Myers	119,000

The district officer recommends a depth of 12 feet throughout, but states that if a part of the project only is provided for, the channel over the bar should be considered the most important part, and that this channel might be combined with any one of the others deemed advisable to Fort Myers.

4. It appeared from information furnished the Board at the hearing that there has been a material increase in the production of fruits and vegetables in recent years in the vicinity of the Caloosahatchee, and that a large acreage of fruits already planted, but not yet bearing, will still further increase the output of this community in the near future. It was stated that even now at certain periods it is difficult to secure transportation by rail, and that in the absence of a suitable water route it was believed that the output would soon exceed the capacity of present shipping facilities, and that a favorable year would result in a congestion in the transportation of these products to the extent of causing great loss to the community. At present the depth of water in the river and over

the bar is not sufficient to accommodate coastwise vessels, as a result of which the greater part of the products are shipped by rail. Even under existing unfavorable conditions, however, there is some water-borne commerce, stated by the board of trade of Fort Myers to amount to about 46,000 tons. It was explained at the hearing that the natural market for this community is at Mobile, and that the object of those interested was to be able to charter vessels of 10 to 12 feet draft and use them in competition with the presen high rail rates.

5. Based on the information now available, the Board is of opinion that the locality is worthy of further improvement. The division engineer is also of this opinion, and he recommends the 12-foot channel over the bar and the completion upon rectified lines of the existing 7-foot project to Fort Myers, the estimated cost of which is $101,000. It will be noted that a depth of 12 feet over the bar and 10 feet deep to Fort Myers is estimated to cost $119,000, or only $18,000 more than the plan recommended by the division engineer. The 12-foot depth over the bar will admit to the mouth of the river, at practically all times, vessels drawing from 10 to 11½ feet, and by taking advantage of the tides these vessels could proceed to Fort Myers on a 10-foot depth. It appears to the Board that the advantages to be gained by having these vessels reach Fort Myers will be more than sufficient to compensate for the additional cost, and it therefore recommends a project for a channel 200 feet wide and 12 feet deep over the bar, and 100 feet wide and 10 feet deep thence to Fort Myers, with a turning basin at that point, at an estimated cost of $119,000 and $2,000 annually for maintenance.

For the Board:

Very respectfully,

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

THE CHIEF OF ENGINEERS, U. S. ARMY,
Washington, D. C.

CRYSTAL, ANCLOTE, AND SUWANEE RIVERS, FLORIDA.

These works were consolidated by the act of June 13, 1902, and included Manatee and Withlacoochee rivers. The river and harbor act of March 3, 1905, made separate provision for Manatee River, and the act of March 2, 1907, made separate provisions for Withlacoochee River.

(*a*) *Crystal River.*—Before improvement the channel from the Gulf of Mexico to the town of Crystal River was tortuous and shallow, the least depth being 2.7 feet at mean low water. The entrance to the river was obstructed by reefs and sand bars.

The project, adopted June 13, 1902, contemplates a channel 60 feet wide and 6 feet deep at mean low water from the Gulf to the town of Crystal River. The estimated cost was $84,647.46.

The total expenditure to June 30, 1909, was $23,482.40, of which $2,700 was for completion of the dredge *Florida.*

The project was completed on December 6, 1906.

The maximum draft that can be carried at mean low water is 2.7 feet. Mean rise and fall of the tide is 2.3 feet.

The town of Crystal River is at the head of navigation, and the length of the navigable channel is 9 miles.

Maintenance work is needed in this river, and it is propseed to undertake this work with government dredge at an early date with the balance available.

The amount estimated as a profitable expenditure during fiscal year ending June 30, 1911, will be needed for maintenance during that fiscal year in order to keep the improvement available.

The commerce of Crystal River is in lumber, pencil cedar, oysters, fish, and general merchandise. The value of the commerce for the year 1908 was $1,250,000.

Tonnage by years: 1902, 1,785; 1903, 725; 1904, 6,875; 1905, 7,474; 1906, 8,291; 1907, 7,888; 1908, 48,742.

The freight rates have been lowered 10 per cent since the improvement was undertaken.

For references to examinations and surveys, see page 296 of Report of Chief Engineers for 1904, and page 369 of report for 1908.

July 1, 1908, balance unexpended	$1,730.05
Amount allotted from appropriation by river and harbor act approved March 3, 1909	3,000.00
	4,730.05
June 30, 1909, amount expended during fiscal year, for works of improvement	5.73
July 1, 1909, balance unexpended	4,724.32
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	2,000.00

(*b*) *Anclote River, Florida.*—Before improvement the channel below Tarpon Springs was narrow and tortuous and obstructed by shoals. The least mean low-water depth was 2 feet.

The project, adopted March 3, 1899, contemplates a channel 100 feet wide and 6 feet deep at mean low water from Anclote anchorage to Sponge Harbor, and thence 4 feet deep at mean low water to the county bridge at Tarpon Springs. The estimated cost was $51,500.

The total expenditure to June 30, 1909, was $37,150.50. There is now a channel 6 feet deep and 100 feet wide from the mouth of the river to Anclote, and 4 feet deep and 100 feet wide thence to the county bridge at Tarpon Springs. The projected width of channel over the outer shoals in Anclote anchorage has not yet been secured, and the amount estimated as a profitable expenditure during fiscal year ending June 30, 1911, it is proposed to expend in securing a full width of channel at this point. This is necessary in order to make the full improvement available.

The maximum draft that can be carried at mean low tide to Sponge Harbor is 6 feet; to the county bridge at Tarpon Springs is 4 feet.

The mean rise and fall of tide at Anclote River entrance is 2 feet. The head of navigation is the county bridge at Tarpon Springs. The length of the navigable channel is 5 miles.

The commerce of Anclote River is in sponges, lumber, naval stores, and general merchandise.

Tonnage, by years: 1899, 1,441; 1900, 1,000; 1903, 2,138; 1904, 8,310; 1905, 31,050; 1908, 5,215.

The freight rates have been lowered about 20 per cent.

The project was 72 per cent completed at end of the fiscal year.

For reference to examination and survey, see page 297 of Report of Chief of Engineers for 1904.

It is proposed to expend the available funds in dredging in continuation of the improvement.

Amount (estimated) required for completion of existing project.... $14,500.00

(*c*) *Suwanee River, Florida.*—Before improvement the channel in the Suwanee River was narrow and tortuous and obstructed by a bar at the entrance and by bowlders, soft rock shoals, snags, and overhanging trees. The least depth at mean low-water stage was 15 inches.

The project adopted in 1879 provides for a channel 150 feet wide and 5 feet deep from the mouth to Rollands Bluff (75 miles) and thence 60 feet wide and 4 feet deep to Ellaville (60 miles). This is to be secured by dredging, building wing dams, and snagging. The estimated cost is $65,158.

The total expenditure up to June 30, 1909, was $69,451.72, of which $9,203.96 was for maintenance.

The project was 92 per cent completed on June 30, 1909.

As a result there is now a channel 5.8 feet deep at mean low water and 50 feet wide from the Gulf of Mexico to a distance of one-half mile above the mouth of the river, and thence to Rollands Bluff a channel 5 feet deep at mean low water and 100 feet wide. From Rollands Bluff to Beesons shoal, 2½ miles below Ellaville, there is a channel 4 feet deep at mean low water and varying from 30 to 100 feet in width.

Full channel width has not, however, been secured through the shallow entrance to Suwanee Bay, and it is proposed to expend the available funds for this widening, completing the project, and in maintenance. This work is for the purpose of making the improvement fully available.

The maximum draft that can be carried at the river entrance is about 4 feet.

Mean rise and fall of tide at Suwanee River entrance is 2.4 feet. The annual variation of the water surface in upper river on account of freshets is about 5 feet.

The village of Ellaville is at the head of navigation. Length of the navigable channel is 135 miles.

The commerce of Suwanee River is in lumber, naval stores, and general merchandise. The value of the commerce for the year 1908 was $287,500.

Tonnage, by years: 1898, 106,346; 1899, 76,878; 1904, 7,658; 1907, 25,705; 1908, 11,590.5.

The improvement has had no effect on freight rates. Only three steamers now operate on the river occasionally.

CONSOLIDATED.

July 1, 1908, balance unexpended		$25,150.79
Amount allotted from appropriation by river and harbor act approved March 3, 1909		8,000.00
		33,150.79
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$16,035.56	
For maintenance of improvement	1,256.23	
		17,291.79
July 1, 1909, balance unexpended		15,859.00
July 1, 1909, outstanding liabilities		1,632.45
July 1, 1909, balance available		14,226.55
Amount (estimated) required for completion of existing project		14,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		16,500.00

HILLSBORO RIVER, FLORIDA.

The following is from the annual report of the Chief of Engineers, under heading "Hillsboro Bay:"

Before improvement the channel from deep water in Hillsboro Bay to the city of Tampa was narrow and tortuous, with least depth of about 4 feet at mean low water.

The first project, adopted in 1880, provided for a channel 9 feet deep at mean low water, 150 feet wide in the bay and 200 feet wide in Hillsboro River. In 1888 the proposed depth was reduced to 8 feet. This project was practically completed in 1893, at a cost of $80,000.

A second project, adopted March 3, 1899, contemplated a channel 12 feet deep at mean low water, 150 feet wide in the bay and 200 feet wide in the river, from the 12-foot contour in the bay to a point 100 feet south of the Lafayette Street Bridge in Hillsboro River. The estimated cost was $300,000. The total expenditure under this project was $275,000. The project was completed, except that the width in a small part of the bay channel was only 110 feet.

A new project, adopted March 3, 1905, provided for a channel 20 feet deep at mean low water and 150 feet wide from the lower bay to the mouth of Hillsboro River, with a turning basin at inner end 450 feet wide and 1,050 feet long, at an estimated cost of $448,350. The work was completed on February 29, 1908. The full depth was obtained in the channel excepting in the northwesterly end of the turning basin, where there is a minimum depth of 16.8 feet at mean low water, over a small area where ledge rock is found.

During the fiscal year ended June 30, 1909, the three turns in channel were widened, the turning basin restored to its original depth, and a dolphin constructed near westerly edge of turning basin.

The total expenditure to June 30, 1909, under this project was $448,642.60, of which $37,628.07 was for maintenance. The amount derived from miscellaneous sources was $207.05.

The result of this work has been to make Tampa a terminal point for two railroads and a point of call for freight and passenger steamers plying between Gulf and Atlantic ports.

The maximum draft that can be carried at mean low water through Hillsboro Bay to the head of the turning basin, 360 feet from the mouth of Hillsboro River, is 20 feet. Mean rise and fall of the tide in Hillsboro Bay is 2.2 feet.

The head of navigation for 20-foot draft vessels is Hendry & Knights Garrison dock at Tampa, which is situated on a channel connecting with the turning basin that was dredged by private capital. The head of navigation is 41 miles from deep water in the Gulf of Mexico. Hillsboro Bay is navigable in fact over its entire area.

The commerce of Hillsboro Bay is in cigars, coal, fertilizers, grain, lumber, phosphate, and tobacco. The value of the commerce for the calendar year 1908 was $16,145,504.

Tonnage by years: 1898, 32,070; 1899, 87,740; 1900, 96,029; 1901, 131,208; 1902, 169,844; 1903, 228,252; 1904, 274,399; 1905, 307,460; 1906, 450,056; 1907, 520,629; 1908, 560,281.

During the fiscal year with an allotment of $1,000 made from the emergency appropriation of March 2, 1907, the usual channel depths in the river to Lafayette Street Bridge were restored.

The freight rates by water were lowered about 10 per cent during the last calendar year, and have been lowered about 35 per cent since the improvement was undertaken.

For references to examinations and surveys see page 295 of Report of the Chief of Engineers for 1904, and House Document No. 1121, Sixtieth Congress, second session.

It is proposed to expend the available balance and the additional appropriation recommended for maintenance of the project.

July 1, 1908, balance unexpended	$37,548.50
Amount allotted from appropriation by river and harbor act approved March 3, 1909	10,000.00
December 15, 1908, allotted from emergency appropriation, act of March 2, 1907	1,000.00
Receipts from sales	16.45
	48,564.95

June 30, 1909, amount expended during fiscal year:		
For works of improvement	$36,628.07	
For maintenance of improvement	1,000.00	
		$37,628.07
July 1, 1909, balance unexpended		10,936.88
July 1, 1909, outstanding liabilities		100.00
July 1, 1909, balance available		10,836.88
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		10,000.00

HOLMES RIVER, FLORIDA, FROM VERNON TO ITS MOUTH.

Holmes River empties into the Choctawhatchee River. Before improvement it was obstructed by sunken logs, fallen timber, and overhanging trees, and was only available for navigation by small sailing craft and barges, which occasionally made trips up to Vernon.

The present project for the improvement of the stream provides for making a navigable channel by removing logs and snags from the river and overhanging trees from its banks from the mouth up to the town of Vernon.

The total amount expended on this improvement up to the close of the fiscal year ending June 13, 1909, was $16,085.38, of which $13,160.95 was upon Holmes River and $2,160.80 upon Lagrange Bayou.

The project has been completed and additional work required is for maintenance.

The operations during the year consisted in snagging for maintenance of the channel to Vernon, the head of navigation.

The importance of this improvement has greatly increased in the last few years, and five steamers are now engaged in the large and growing trade between Vernon and Pensacola.

The commerce of the stream consists of cotton, turpentine, rosin, molasses, honey, and miscellaneous articles, the value of which in 1908 was $640,000.

As this river is the only means of transportation in that section, there is no basis for comparison and the effect of the improvement on freight rates can not be stated.

July 1, 1908, balance unexpended		$678.25
Amount allotted from appropriation by river and harbor act approved March 3, 1909		2,000.00
		2,678.25
June 30, 1909, amount expended during fiscal year, for maintenance of improvement		763.63
July 1, 1909, balance unexpended		1,914.62
July 1, 1909, outstanding liabilities		438.24
July 1, 1909, balance available		1,476.38
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		2,000.00

INDIAN RIVER, FLORIDA, BETWEEN GOAT CREEK AND JUPITER INLET.

Indian River is a narrow sound between the coast and an outlying fringe of islands. Before improvement the ruling depth was 2.5 feet. The tide is negligible.

The project adopted in 1891 provides for a continuous channel between Goat Creek and Jupiter Inlet 5 feet deep at mean low water and at least 75 feet wide in the straight reaches, with as much greater width as may be required in the turns. The estimated cost is $44,000.

The total expenditure up to June 30, 1909, was $57,878.09, of which $21,191.23 was for maintenance. As a result a channel was obtained 5 feet deep and nowhere less than 50 feet wide between Goat Creek and Pecks Lake.

The project is about 80 per cent completed.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, to deepening and widening existing channels, completing the project, and to work of maintenance. The additional work proposed is to make the improvement available.

During the year an examination disclosed that, due to the fact that the spoil banks from dredging were submerged and the channel unmarked, boats were continually grounding on the spoil banks and breaking them down and shoaling the channel. To prevent this, and as an aid in maintenance dredging, substantial channel marks were established. Maintenance dredging is required at several places where not over 4 feet of water exists, which is the maximum depth which can be carried June 30, 1909.

The improvement has had no effect on railroad freight rates, as the stream has no connection with a deep-water port. The river is much used by those engaged in vegetable and fruit culture as a line of communication between packing houses and the nearest railroad station, thus causing a very considerable saving to the producer. The river is an important link in the inside passage along the east coast of Florida and is much used by launches and an auxiliary schooner trading between Lake Worth and Jacksonville. The length of navigable channel under improvement by the Government is 77 miles. The stream, or, more properly, the sound, is navigable in fact, partly through private canals, from St. Augustine to Key West, a distance of 490 miles.

It has been impracticable to secure trustworthy statistics of this commerce, but it is very considerable.

Jupiter Inlet.—This inlet having closed again, an allotment of $2,000 was made June 8, 1909, from the appropriation of $300,000 provided by the emergency river and harbor act of March 3, 1905, to restore the opening. Work under this allotment will begin shortly after the close of the fiscal year.

The total expenditure to June 30, 1909, was $1,500.

July 1, 1908, balance unexpended	$3,642.26
July 27, 1908, and June 8, 1909, allotments ($2,000 each) from emergency appropriation, act of March 3, 1905	4,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	4,000.00
Receipts from sales	5.00
	11,647.26

June 30, 1909, amount expended during fiscal year, for maintenance of improvement	$5,505.73	
Refunded to credit of emergency appropriation	2,000.00	
		$7,505.73
July 1, 1909, balance unexpended		4,141.53
July 1, 1909, outstanding liabilities		550.00
July 1, 1909, balance available		3,591.53
Amount (estimated) required for completion of existing project		9,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		13,000.00

KISSIMMEE RIVER, FLORIDA.

Before improvement the Kissimmee River was tortuous, shallow, and obstructed by snags and overhanging trees. At ordinary stages the least depth was about 2 feet, and in dry seasons navigation was altogether suspended. Canals had been made through some of the worst bends by private enterprise.

The project adopted June 13, 1902, provided for a channel 30 to 60 feet wide and 3 feet deep at ordinary low-water stages in the Kissimmee River (including the connecting canals and lakes) from the town of Kissimmee to Fort Bassinger, and for a channel 25 feet wide and 3 feet deep in Istokpoga Creek. The estimated cost of the improvement was $24,220.90.

The total expenditure up to June 30, 1909, was $27,138.72, of which $6,362.64 was for maintenance. The project is completed.

The result has been a deepening of the channel to a depth of 3 feet from the town of Kissimmee to Fort Bassinger, at ordinary stages of the river, and the clearing of Istokpoga Creek.

The town of Kissimmee is at the head of navigation. The stream is navigable in fact to the Gulf of Mexico, via Lake Okechobee and Caloosahatchee River, a distance of 309 miles. During periods of extreme drought the river is navigable for launches only, but during eight months of the year steamboat navigation is possible.

The commerce of Kissimmee River is in lumber, cattle, fish, naval stores, fruits, vegetables, and general merchandise.

Tonnage by years: 1901, 3,670; 1902, 9,655; 1903, 10,652; 1904, 2,863; 1905, 9,911; 1906, 10,111; 1908 (estimated), 10,000.

The improvement of the stream has lowered freight rates on the supplies handled 75 per cent. There is no rail communication to the country adjacent to this stream, the only other line of supply being by wagon line over poor roads.

Failure to maintain the stream in its present improved state would be no less than a calamity to those living in the lower Kissimmee valley.

During the year $2,703.10 has been expended in clearing away overhanging limbs, in closing subsidiary channels, and in dredging.

On June 30, 1909, there is an available channel having a depth of 24 inches, barely sufficient for the steamboats operating on the stream.

The appropriation recommended is for maintenance of the improvement. The work proposed is to make the improvement available for the ensuing year.

July 1, 1908, balance unexpended	$2,785.38
May 21, 1909, allotted from emergency appropriation act of March 3, 1905	600.00
Receipts from sales	26.00
	3,411.38
June 30, 1909, amount expended during fiscal year, for works of improvement	2,703.10
July 1, 1909, balance unexpended	708.28
July 1, 1909, outstanding liabilities	300.00
July 1, 1909, balance available	408.28
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

OKLAWAHA RIVER, FLORIDA.

Before improvement this river was obstructed by snags, accumulation of drift, and overhanging trees.

The project, adopted in 1891, was to clear the river of obstructions, so as to give a navigable channel 4 feet deep at mean low stage from the mouth to Leesburg, a distance of 94 miles, at an estimated cost of $26,000. This was modified by the river and harbor act of March 2, 1907, which provided for removing obstructions and deepening the channel to 6 feet at mean low water from the mouth of the Oklawaha to the head of Silver Springs Run at an estimated additional cost of $15,000. This project is printed in House Document No. 782, Fifty-ninth Congress, first session.

Up to June 30, 1909, the total expenditure under this project was $38,894.41, of which $16,292.12 was for work of maintenance.

As a general result, there is a fairly well-cleared channel 6 feet deep for the first 32 miles of the stream, a practicable channel 4 feet deep at ordinary low stages of the river to Silver Springs Run, 53 miles from the St. Johns River, and a channel 3 feet deep at ordinary stage of water to Leesburg, 94 miles from the mouth. Leesburg is the head of steamboat navigation.

Silver Springs Run, 5½ miles long from the Oklawaha to its head at Silver Springs, affords the best channel of the entire route.

As a result of the expenditure for maintenance, several shoal places have been dredged and many snags and overhanging trees removed.

The original project is believed to be about 55 per cent completed, but owing to the fact that logs and snags are carried by freshets into the stream or moved from the sides into the channel, more work will have to be done that can be estimated from examination or survey.

During freshets the water sometimes rises to a height of 4 feet above its normal stage.

The improvement has had no appreciable effect upon freight rates.

The commerce concerned is small. The boats using the river are chiefly excursion steamers, which run during the winter months. One steamer, however, runs regularly during the entire year and affords the only means of communication for the adjacent country.

A considerable revival in interest in this stream is noticeable among the business men at Leesburg, which is situated at the head of navigation, and at Ocala, which is situated 6 miles from the head of

Silver Springs Run, and it is quite probable that the completion of the project would have a very decided effect on railroad rates. The river is navigable in fact to Lake Apopka, 130 miles.

Tonnage by years: 1898, 4,481; 1899, 4,291; 1900, 4,847; 1901, 4,530; 1906, 9,298; 1907, 9,129; 1908, 80,279.

On March 17, 1909, the sum of $4,000 was allotted from the appropriation of $8,185,750 provided by the river and harbor act of March 3, 1909, to be applied to the maintenance of this improvement. No work had been done under this allotment at the end of the fiscal year. The amount expended was for examination of the channel and for engineering contingencies.

It is proposed to apply the amount estimated as a profitable expenditure in the fiscal year ending June 30, 1911, to making certain cut-offs, dredging shoals, and removing snags and overhanging trees in the lower river, and in deepening shoal places in the upper river. The additional work proposed is for the purpose of extension of benefits and for maintenance.

July 1, 1908, balance unexpended	$189.64
Amount allotted from appropriation by river and harbor act approved March 3, 1909	4,000.00
	4,189.64
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	84.05
July 1, 1909, balance unexpended	4,105.59
Amount (estimated) required for completion of existing project	18,208.07
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	20,710.00

ORANGE RIVER, FLORIDA.

These works were consolidated by the act of June 13, 1902.

(*a*) *Orange River.*—Before improvement the least depth was 2.5 feet at mean low water, and the channel was obstructed by snags and overhanging trees.

The project, adopted June 13, 1902, provides for a channel 50 feet wide and 4 feet deep at mean low water from the mouth of the river to the head of navigation. The estimated cost was $2,500.

The total expenditure to June 30, 1909, was $4,000, of which $2,000 was for work of maintenance. No work was done during the past year.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, to maintenance.

There is now a navigable channel 50 feet wide and 4 feet deep at mean low water from the mouth of the river to the head of navigation, excepting in the upper portion of the river the full channel width could not be obtained on account of the river width being less than 50 feet.

The mean rise and fall of the tide is 1 foot. The annual variation of water level on account of freshets is about 2 feet. The maximum draft that can be carried at mean low water is 4 feet.

The head of navigation is the iron bridge at Buckingham, about 5½ miles from the mouth of the river.

The commerce of Orange River is in fruits, vegetables, fertilizers, lumber, and general merchandise. The value of the commerce for the year 1907 was $277,669.34.

Tonnage by years: 1896, 1,250; 1902, 7,155; 1903, 8,555; 1904, 3,099; 1905, 2,074; 1906, 6,258; 1907, 4,002; 1908, 3,936½.

The freight rates are practically the same as before the improvement was made.

This river has previously been united with the Charlotte and Caloosahatchee rivers in appropriations, and the following money statement applies to the group:

CONSOLIDATED.

July 1, 1908, balance unexpended		$3,031.24
Amount allotted from appropriation by river and harbor act approved March 3, 1909		1,000.00
		4,031.24
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$31.24	
For maintenance of improvement	54.44	
		85.68
July 1, 1909, balance unexpended		3,945.56
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		5,000.00

ST. JOHNS RIVER, FLORIDA.

(*a*) *St. Johns River, Jacksonville to the ocean.*—This work includes the improvement of the bar at the river mouth and the improvement of the channel from the bar to Jacksonville, a distance of 27.5 miles. Before improvement there was a varying channel across the bar, sometimes 5, sometimes 7 feet deep, and shifting in location through a north and south range of 1 mile. Between the bar and Jacksonville the channel had a least mean low-water depth (at Dames Point) of 11.5 feet.

The range of tide is 5.22 feet at the bar, 4.3 feet at Mayport, 1.8 feet at Dames Point, and 0.8 foot at Jacksonville.

The first project of improvement, adopted in 1879, contemplated a channel 15 feet deep at mean low water from Jacksonville to the ocean. This was to be obtained by dredging and building training walls in the river and by building two stone jetties converging upon the bar, 1,600 feet apart at their outer ends. Under this project the sum of $1,417,000 was expended. As a result the bar channel was fixed and deepened to 13 feet, and the river channel was deepened to 16.5 feet.

The present project, adopted in 1896 and modified in 1903, contemplates a channel from Jacksonville to the ocean 300 feet wide and 24 feet deep, except at Dames Point, where the width was to be 400 feet and the depth 25 feet, this channel to be obtained by dredging and building training walls in the river and by raising and extending the jetties. The estimated cost was $2,109,750, increased in 1908 to $2,176,750, of which $67,000 remains to be appropriated.

The funds appropriated have been expended in building a seagoing suction dredge (*St. Johns*) and a river dredge (*Jacksonville*), in dredging with the plant thus provided and by contract, in building

training walls, and in raising and extending the jetties at the entrance. The total expenditure to June 30, 1909, was $2,255,489.80, of which $175,175.99 was for construction of a seagoing dredge and $227,933.39 for work of maintenance. The result has been the completion of the channel contemplated by the project, excepting through the shoals at Trout Creek and at White Shells. At the first place the channel is only about 230 feet wide, the remaining 70 feet being obstructed by rock and soft material.

At White Shells the channel is narrowed about 60 feet by a ledge of coquina rock and has filled in until its width is not more than 150 feet. Shoaling occurred in Browns Creek cut and in Fulton cut, requiring work of maintenance. In these localities the United States dredge *Key West* removed from the channel 153,067 cubic yards of material at a cost of $10.000, restoring projected depths through these cuts to a width varying from 150 to 300 feet. Shoaling at Mile Point cut and at White Shells cut has occurred, and contract has been entered into for dredging at these localities under the allotment of $300,000 for the maintenance of this work made from the appropriation of $8,185,750 in the river and harbor act of March 3, 1909. Under this same allotment contract has been entered into for raising the outer 1,500 feet of the north jetty and filling in critical points in the middle section of that jetty and along the south jetty.

On account of the shoaling at Mile Point and White Shells, the projected depth of 24 feet at mean low tide is not available, it being reduced to 22 feet at Mile Point, but practically a channel having a least available depth of 24 feet does exist, since the increased tidal rise at the shoal localities over that in the upper portion of the river compensates for the decreased depth at low tide.

The increased length and draft of the ships now entering the port of Jacksonville indicates that widening is needed at several bends in the channel, notably at the upper end of Fulton Reach and Browns Creek and at the New Berlin bend. The increased size and speed of the combined passenger and freight steamers plying this river has caused a considerable washing of banks at several places in the river and indicates the necessity of bank revetment at these points and of increased height of some sections of the training walls.

The channel between the jetties has maintained itself remarkably during the year, indicating that the jetties may be relied upon to do their work with efficiency if properly maintained.

The channel over the outer bar continues to increase in cross section, especially in depth, indicating that a depth over the present projected one could probably be maintained were the channel through Wards Bank trained and concentrated by dredging. It is believed that to properly continue their present efficiency, the north jetty should be restored throughout to its projected height and section and that the south jetty should be also raised to its original height for at least one-half its length.

The district officer estimates that the sum of $200,000 will be required for restoring the jetties to their original cross section where indicated as being desirable; that $85,000 will be required for maintenance by dredging and widening at bends and for necessary bank protection, a total of $285,000, in addition to the sum of $67,000 required to complete the channel at Trout Creek shoal. The project is 97 per cent completed.

The river and harbor act of 1909 provided for a survey of this river with a view toward adopting a more extended project. Should report on this survey lead to the adoption of a new project, the estimate for maintenance would be materially changed.

Were it not for the improvement, freight rates from Florida to northern points would be 50 per cent greater than they are.

The St. Johns River is navigable in fact from the mouth to Lake Washington, a distance of 276 miles, but for deep-draft vessels only as far as Jacksonville, 27.5 miles. The head of steamboat navigation is Lake Poincett, 252 miles from the mouth.

The estimated value of the commerce for 1908 is $60,000,000.

Tonnage by years: 1898, 494,474; 1899, 816,477; 1900, 649,221; 1901, 700,179; 1902, 903,191; 1903, 1,052,076; 1904, 1,000,316; 1905, 1,406,647; 1906, 2,455,101; 1907, 2,485,610; 1908, 1,589,126.

The decrease in tonnage over that given for the years 1906 and 1907 is due, in large part, to the decided falling off in lumber shipments caused by the general commercial depression existing throughout the country. In other respects than that of actual tonnage the commercial activities of the port have largely increased, due to the improved channel. The first shipment of phosphate rock, amounting to 1,600 tons, was made during December, 1908, and charters have already been made for a shipment of at least 200,000 tons of this product during 1909.

During 1908 the following transportation lines were established to this port:

The Gans Line and Burg Line to German ports, and the Logan Line to Liverpool; the Merchants and Miners' Line have made Jacksonville their southern terminus, giving triweekly sailings to Baltimore and Philadelphia; The Jacksonville and Tropical Steamship Line, plying between Jacksonville, Fla., and Habana, Cuba.

To properly estimate the value of the commerce of the port is very difficult, as the value of merchandise shipments, the most valuable portion of the commerce, is known only to the consignees. The more valuable shipments, such as cotton, merchandise, tobacco, etc., have increased, in spite of the general business depression, so considerably as to almost if not quite balance the falling off in the lumber trade. It is believed, therefore, that the estimate of $60,000,000 for the value of the commerce is not too large for the last year.

During the first six months of 1909 the foreign commerce of this port amounted to $1,366,453.08, as against $353,670.10 for the same months of last year, and the net tonnage of ships entering and clearing during the months of April and May amounted to over 500,000 tons.

The port statistics for the year are accurate, having been carefully compiled by a thoroughly efficient man employed by the Jacksonville Board of Trade solely for that purpose.

More detailed information may be found in reports of the Chief of Engineers as listed on page 329 in Report of the Chief of Engineers for 1907.

It is proposed to expend the available balance in prosecuting the work of raising the jetties and maintenance dredging under contract and with hired plant.

It is proposed to apply the amount estimated as a profitable expenditure in the fiscal year ending June 30, 1911, to widening the

channel at turns and critical points, to shore protection, and to maintenance of jetties. This work is required to make the improvement available to the class of traffic invited by the depth of channel.

July 1, 1908, balance unexpended	$1,304.50
August 21, 1908, allotted from emergency appropriation, act of March 3, 1905	10,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	300,000.00
Receipts from sales	7.70
	311,312.20
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	11,671.75
July 1, 1909, balance unexpended	299,640.45
July 1, 1909, outstanding liabilities	154.20
July 1, 1909, balance available	299,486.25
Amount (estimated) required for completion of existing project	67,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	250,000.00

(*b*) *St. Johns River, opposite the city of Jacksonville.*—The project for improving the St. Johns River from Jacksonville to the ocean provides for a channel 24 feet deep. Between the channel and the pierhead lines at the city of Jacksonville the depths are in many places considerably less than 24 feet. A project for securing a depth of 24 feet at mean low water from the existing channel to the pierhead line on the left bank of the river, between the Florida East Coast Railway bridge and Hogans Creek, was adopted by the river and harbor act of March 2, 1907. The estimated cost (raised in 1908) is $586,500.

Work upon this project began October 1, 1907. The work, as far as available funds permit, is nearly completed, the contractor now being engaged in clearing up after the dipper dredge.

The total expenditure to June 30, 1909, was $309,998.61, of which $3,500 was expended for purchase of a site for a warehouse and wharf for the plant engaged on the St. Johns River work, and $1,105.82 for surveys necessary to relocation of harbor line monuments.

Upon completion of the present contract the entire work will be about 60 per cent completed. The result has been a deepening to about 24 feet over the area between the Florida East Coast Railway bridge and the lower Clyde Line docks, but the clear depth has not yet been secured.

The average rise and fall of tide is 0.8 foot, although under special conditions the river sometimes rises to a height of 3 feet above mean low water.

For commercial statistics and other general information, reference is made to the current report and summary on improvement of St. Johns River, Florida.

The work so far completed has, it is believed, had an advantageous effect on freight rates, as it has permitted deeper-draft vessels to reach the wharves, thus obviating the necessity of lightering to midstream.

It is proposed to apply the amount which is estimated as a profitable expenditure in fiscal year ending June 30, 1911, to the completion of the project which is necessary to extend the benefits over the entire frontage contemplated.

July 1, 1908, balance unexpended	$259,140.12
June 30, 1909, amount expended during fiscal year, for works of improvement	197,647.73
July 1, 1909, balance unexpended	61,501.39
July 1, 1909, outstanding liabilities	30,799.51
July 1, 1909, balance available	30,701.88
July 1, 1909, amount covered by uncompleted contracts	13,648.20
Amount (estimated) required for completion of existing project	215,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	215,000.00

(*c*) *St. Johns River, Jacksonville to Lake Harney.*—Report on a recent survey is printed in House Document No. 1111, Sixtieth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 4, 1908.

SIR: I have the honor to submit herewith for transmission to Congress reports of June 3, 1907, by Maj. Francis R. Shunk, Corps of Engineers, on preliminary examination of St. Johns River, Florida, from Jacksonville to Sanford and from Sanford to Lake Harney, and reports of October 1, 1908, with maps, by Capt. George R. Spalding, Corps of Engineers, on survey of St. Johns River from Palatka to Sanford and from Sanford to Lake Harney, these examinations and surveys having been made under authority of two items in section 3 of the river and harbor act approved March 2, 1907.

Of that portion of the St. Johns River from Jacksonville to Sanford (named in one item of the act) the section between Jacksonville and Palatka is at present being improved under a project which provides for securing a depth of 13 feet and width of 200 feet. Some work has also been done in the section between Palatka and Sanford with a view to obtaining a depth of 5 feet at mean low stage.

In his report on the preliminary examination Major Shunk expressed the opinion that the advisability of further improvement depended upon the cost of the work, and he recommended a survey of the whole reach from Jacksonville to Sanford. This recommendation of the district officer was concurred in by the division engineer, Col. Dan C. Kingman, Corps of Engineers. From the facts and for the reasons given in its report of July 29, 1907, however, the Board of Engineers for Rivers and Harbors concluded that further improvement of the river between Jacksonville and Palatka would not be justified at the present time, and recommended a survey from the latter point to Sanford only. The Chief of Engineers concurring in the views of the Board, recommendation accordingly was made to the Secretary of War, and survey from Palatka to Sanford only was ordered.

In his survey report of October 1, 1908, Captain Spalding presents an estimate of cost of the necessary dredging to secure a channel 8 feet deep at mean low water and 100 feet wide from Palatka to Sanford, amounting to $100,000, and $5,000 annually for maintenance after completion. I concur in the view of the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors that this section of the river is worthy of improvement to the extent indicated.

The division engineer differs with the district officer as to the details of the work proposed at a given point, but it is believed that this is a matter that may properly be left for determination at the time when the work, if authorized, shall actually be undertaken.

No work has ever been done by the United States on St. Johns River between Sanford and Lake Harney. The plan of improvement presented by Captain

Spalding's separate report of October 1, 1908, has for its object the securing of a channel between these points 5 feet deep at mean low water and 100 feet wide, at an estimated first cost of $20,600, and $1,000 a year for maintenance after completion.

I concur in the opinion of the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors that this reach of the river is worthy of improvement to the extent proposed.

While the examinations and surveys herein considered were authorized by two separate items in the act, the relation between the sections of the river involved is so intimate that it seems expedient to present them together; and I recommend that, should Congress decide to adopt the two separate plans of improvement proposed, the work be authorized under one appropriation for improving St. Johns River from Palatka to Lake Harney, rather than under two appropriations for the separate sections estimated for, i. e., from Palatka to Sanford and from Sanford to Lake Harney.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

THE SECRETARY OF WAR.

The commerce on this stretch of river is reported to amount to a little over 60,000 tons, and to be increasing. The existence of a commerce of this size on a portion of the river where no improvement has been undertaken would appear to warrant the assumption that further development will result from improved facilities for navigation.

WITHLACOOCHEE RIVER, FLORIDA.

Before improvement the entrance to the Withlacoochee River was crooked and obstructed by reefs. The least depth at mean low water was about 3 feet. Vessels loaded and discharged at an anchorage (called the loading pool) about 9 miles from the entrance. Inside the mouth there was a depth of 7 to 8 feet as far as Inglis, a distance of 9 miles.

The original project, adopted in 1879, provided for a channel having an available depth of 2 feet during about half the year from the mouth of the river to Pembertons Ferry, a distance of 77 miles, and was completed in 1892, at a cost of $24,403.62. A balance of $296.38, together with $5,000 from the consolidated appropriation made by the river and harbor act of 1902, was applied to the construction of the dredge *Florida*.

A project adopted June 13, 1902, provided for straightening the channel from the loading pool to the river mouth and deepening it to 8 feet, and for work of maintenance.

The amount expended to June 30, 1907, was $30,000.41. As a result a channel was obtained with a least depth of 7.8 feet at mean low water and a least width of 60 feet through the most obstructive shoals.

A good deal of dredging has been done by the Port Inglis Terminal Company, under permission granted by the Secretary of War.

The present project, adopted by the river and harbor act of March 2, 1907, provides for a channel 100 feet wide and 10 feet deep at mean low water from Port Inglis to the anchorage in the Gulf of Mexico, at an estimated cost of $215,400 and $5,000 annually for maintenance. The act authorized continuing contracts for completing the work in the sum of $150,000, all of which has been appropriated. Work under this project began April 11, 1908, and at the end of the fiscal year the project was about 20 per cent completed. The amount expended on present project to June 30, 1909, was $47,619.

The head of steamboat navigation is at the county bridge, about 2 miles below Istachatta, or 76 miles above the mouth. The river is navigable, in fact, to Dobes Fish Hole, about 112 miles above the mouth.

It is proposed to apply the amount estimated as a profitable expenditure in the fiscal year ending June 30, 1911, to maintenance in order to keep available the improvement secured under both old and new projects.

The mean rise and fall of tide at Withlacoochee River entrance is 2.8 feet. The annual variation of water surface in the upper river on account of freshets is about 6 feet.

Length of the navigable channel from the loading pool in the Gulf of Mexico to Port Inglis, at mouth of the river, is 9 miles; thence up the river to Inglis, 9 miles; thence to Pembertons Ferry, 68 miles.

The commerce of Withlacoochee River is in phosphate, lumber, coal, iron pyrites, and general merchandise. Port Inglis, at mouth of the river, is a subport of entry. Vessels ply regularly from the anchorage basin off the river entrance to European ports with cargoes of phosphate.

The value of commerce for 1908 was $2,000,000.

Tonnage, by years: 1899, 4,941; 1900, 2,550; 1902, 74,047; 1903, 115,269; 1904, 123,369; 1905, 249,884; 1906, 181,226; 1907, 206,509; 1908, 198,610.

The freight rates have been reduced about 30 per cent since the improvement was begun.

It is proposed to expend the available funds for dredging.

For report on preliminary examination and survey authorized by the river and harbor act of March 3, 1905, see House Document No. 483, Fifty-ninth Congress, second session.

July 1, 1908, balance unexpended	$164,210.31
Amount appropriated by sundry civil act approved March 4, 1909	50,000.00
	214,210.31
June 30, 1909, amount expended during fiscal year, for works of improvement	46,429.31
July 1, 1909, balance unexpended	167,781.00
July 1, 1909, outstanding liabilities	11,635.27
July 1, 1909, balance available	156,145.73
July 1, 1909, amount covered by uncompleted contracts	142,256.45
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	12,000.00

REMOVING THE WATER HYACINTH FROM FLORIDA WATERS.

Before improvement many Florida rivers, especially the St. Johns and its tributaries, were badly obstructed by packs of hyacinths. The first project, adopted March 3, 1899, provided for the construction of a boat and booms and for destroying the water hyacinths by crushing. The estimated cost was $36,000, plus an undetermined amount for annual expenditure. Nothing was done under this project, as experience in Louisiana showed that destruction by crushing was impracticable.

In 1902 a new project was adopted, providing for the destruction of the hyacinths by any means whatsoever. The plan adopted under this project was to spray the plants with an arsenical compound. The estimated cost was $50,000 per annum.

Under this project the sum of $84,977.97 was expended. A steamer was purchased and fitted up for spraying, and the main stream of the St. Johns River and a number of tributaries were cleared of hyacinths.

The act of 1905 modified the project by prohibiting any process injurious to cattle. The plan consequently adopted is to close inlets, sloughs, etc., with booms, to break up the packs with a suitable boat, and propel them into the current in order that they may float away.

Work during the year was done on Black Creek, Peters Creek, Highland Park Canal, and Norris Cut, tributaries of the St. Johns River, at Volusia bar, in Kissimmee River, Orange River, and Withlacoochee River, Florida.

The total expenditure up to June 30, 1909, was $113,432.34. In addition to the information obtained as a result of exhaustive experiments, the St. Johns River and many of its tributaries, most of the Kissimmee River, and Orange River were cleared of hyacinths, in so far as they formed an obstruction to navigation.

It is expected that the available balance will be expended in removing the hyacinth from the navigable streams of Florida.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, to continuing work of removing water hyacinths. The additional work proposed is for the purpose of extension of benefits.

July 1, 1908, balance unexpended	$18,158.20
June 30, 1909, amount expended during fiscal year, for works of improvement	5,173.74
July 1, 1909, balance unexpended	12,984.46
July 1, 1909, outstanding liabilities	729.94
July 1, 1909, balance available	12,254.52
Amount (estimated) required for completion of existing project	Indefinite.
Amount that can be profitably expended in fiscal year ending June 30, 1911, exclusive of the balance unexpended July 1, 1909	10,000.00

CHOCTAWHATCHEE RIVER, FLORIDA AND ALABAMA.

The Choctawhatchee River is 162 miles long from Newton, Ala., to its mouth, in Choctawhatchee Bay, an arm of the Gulf of Mexico.

Originally the river was impassable during low water for about 10 miles below Newton, due to marl reefs and fish-trap dams, and for the remaining 152 miles to the mouth it was much obstructed by snags, logs, overhanging trees, and sand and gravel bars.

The project for the improvement, as amended in 1890, contemplates the creation of a low-water navigable channel throughout by removing logs, snags, and overhanging trees, by excavating rock and marl shoals, and by contraction works and shore protection, at an estimated cost of $112,832.

The amount expended on this river under the existing project (i. e., since 1874) up to the close of the fiscal year ending June 30,

1909, was $187,455.97, of which the greater part has been expended in maintenance. The expenditures prior to 1874 amounted to $12,876.62.

The project has been completed and the additional work required is for maintenance.

The following results have been accomplished:

A channel 40 feet wide and 3 feet deep has been blasted through the marl shoals below Newton to the lower end of these shoals above Pates Landing. The river has been partially cleared of snags and other obstructions from Pates Landing to Geneva, but above Pates Landing to the foot of the shoals it is impassable at lower stages of water. A fairly navigable channel 3½ feet deep at low water was secured by snagging and works of regulation from Geneva to Caryville, but is again much obstructed. The remainder of the lower river has repeatedly been cleared of obstructions, but is at present much obstructed, except the section below the mouth of the Holmes River, which is in fair condition. A channel 75 feet wide and 6 feet deep at mean low water was dredged through the bar at the mouth of the river (Cypress Top).

The actual head of navigation at low water on June 30, 1909, was the mouth of the Holmes River, 33 miles above the mouth of the river. The minimum draft that could be carried to this point was about 3 feet, but the draft is at least 1 foot greater, except at Sandy reach, where trouble has recently developed.

The effect of the improvement on freight rates, if any, can not be stated.

The additional appropriation recommended will be applied to removal of obstructions for maintenance of improvement below Geneva.

There is no commerce on the river above Geneva, with the possible exception of a small movement of logs. Below Geneva there is a large commerce in logs and hewn timber, and five steamers ply between Pensacola and Vernon on the Holmes River.

The commerce on this stream is mainly saw logs, timber, naval stores, and general merchandise, reported at a valuation of $2,211,651 for the calendar year 1908.

For reference to reports on examination of this river, see Annual Report of the Chief of Engineers for 1906, page 343.

July 1, 1908, balance unexpended	$5,869.43
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	10,869.43
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	5,025.40
July 1, 1909, balance unexpended	5,844.03
July 1, 1909, outstanding liabilities	522.33
July 1, 1909, balance available	5,321.70
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	5,000.00

ESCAMBIA AND CONECUH RIVERS, FLORIDA AND ALABAMA.

These two names apply to one and the same stream, which flows through a heavily timbered country in southern Alabama and western Florida into Escambia Bay, an arm of Pensacola Bay. The change of name occurs at the boundary line between the two States. The timber from this district is brought down the river and forms a large part of all that is exported from Pensacola. Originally the river was much obstructed by snags, marl reefs, and sand bars, and a bar at its mouth, where the rafts are made ready to be towed to Pensacola, prevented the entrance of tugs and seriously interfered with navigation.

The first appropriation for the improvement of this river was made in 1833, and prior to the adoption of the present project $5,000 was expended in removing obstructions. A subsequent appropriation of $5,500, made in 1836, was returned to the surplus fund in 1838. No further appropriations were made until 1880.

(*a*) *General improvement.*—The present project, as originally adopted June 14, 1880, provided for the improvement of the river from its mouth to Indian Creek, Alabama, an estimated distance of 293 miles, by the removal of snags, logs, and overhanging trees, by excavating rock shoals, by works of contraction and shore protection, and by dredging a channel 150 feet wide and 5½ feet deep at mean low water through the bar at the mouth, all at an estimated cost of $87,430, but the recent adoption of a separate project for the Conecuh River has, in effect, fixed the upper limit of the improvement as the mouth of Patsaliga Creek. The project has been completed, and additional work required is for maintenance.

The amount expended on this project to June 30, 1909, was $153,101.94, largely for maintenance. These expenditures have kept the river fairly free from snags, opened the channel across the bar at the mouth from time to time, and greatly facilitated the rafting and towing of timber; but, due to lack of funds in recent years, the river, which in 1900 was practically free from obstructions from its mouth to near the mouth of Patsaliga Creek, again became so much obstructed as to seriously interfere with the rafting at low-water stages. During the year the stream was cleared of obstructions for a distance of 162 miles.

It is proposed to apply the appropriation recommended in snagging and dredging toward maintenance of the improvement.

Reference to reports of examination of this improvement will be found on pages 348 and 349 of the Report of the Chief of Engineers for 1906.

(*b*) *Conecuh River.*—By act of Congress, approved March 2, 1907, a project was adopted for completing the improvement of the Conecuh River from the mouth of Patsaliga Creek to the state line between Florida and Alabama by removal of bowlders, snags, and rock shoals, in accordance with report submitted in House Document No. 159, Fifty-ninth Congress, first session, at an estimated cost of $31,000.

For work under this project a plant consisting of a quarter boat and two working barges has been constructed. The field work commenced July 22, 1907. During the fiscal year ending June 30, 1909, 92 miles of river was worked over, 34 miles being new work. Funds now available will be sufficient to complete the project for this section

of river. Subsequent maintenance can be more conveniently and logically provided for under the general project.

The actual head of navigation during ordinary stages of the river is at the mouth of Patsaliga Creek, about 195 miles above the mouth of the Escambia River.

Commerce consists of timber floated in rafts, the value of which in 1908 is estimated at $3,863,000.

Work now completed influences the transportation of timber on 170 miles of river, which has been greatly facilitated, admitting of rafting on stages of water some 3 feet less than formerly. The freight per thousand by rail from River Falls, a point 3 miles below Patsaliga Creek, to water is $1.50; by river, it is 75 cents.

GENERAL IMPROVEMENT.

July 1, 1908, balance unexpended	$7,913.86
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	12,913.86
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	6,656.37
July 1, 1909, balance unexpended	6,257.49
July 1, 1909, outstanding liabilities	1,735.17
July 1, 1909, balance available	4,522.32
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	5,000.00

MOBILE BAR, ALABAMA.

Mobile bar is located in the Gulf of Mexico off the entrance to Mobile Bay. This bar had a depth of 23 feet at low water over ample width before any work of improvement was commenced upon it. This depth accommodated all the traffic of the Mobile Bay ship channel, but was not sufficient to permit of the utilization of the deep anchorage in lower Mobile Bay beyond the southern limit of the dredged cut leading to the city of Mobile.

The original and existing project for this improvement was adopted in the river and harbor act of June 13, 1902, and provides for the formation of a channel 30 feet deep at low water and 300 feet wide across Mobile bar, at an estimated cost of $91,250. This work of improvement formed a part of the Mobile Harbor project until March 3, 1905, when, by the river and harbor act of that date, it was made a separate project, and the limit of cost was increased to $100,000.

Up to June 30, 1909, the sum of $156,443.49 had been expended on this improvement, of which about $66,443.49 was applied to maintenance.

During the fiscal year the U. S. dredge *Charleston* was engaged about all of her working time removing shoals and increasing the depth and width of this channel. The depth now ranges from 30 to 35 feet at mean low water, except on two shoals near the eastern side of the channel, where the least depth runs as low as 22 feet. The project is about 90 per cent completed.

The maximum draft that can be carried through the channel at mean low water is about 30 feet, and the average range of tide is 1.1 feet.

Available funds and future appropriations will be applied to completing the project and its maintenance and to keeping the dredge *Charleston* in repair.

For commercial statistics and effect of improvement on freight rates, see report on Mobile Harbor.

July 1, 1908, balance unexpended		$25,081.63
June 30, 1909, receipts from sales		4.55
Amount allotted from appropriation by river and harbor act approved March 3, 1909		23,000.00
		48,086.18
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$7,000.00	
For maintenance of improvement	24,525.12	
		31,525.12
July 1, 1909, balance unexpended		16,561.06
July 1, 1909, outstanding liabilities		8,500.00
July 1, 1909, balance available		8,061.06
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		18,000.00

MOBILE HARBOR, ALABAMA.

This channel originally had minimum depths of 5½ feet through Choctaw Pass and 8 feet through Dog River bar, at mean low water, the available draft to Mobile, via Spanish River, being limited to the latter depth.

The improvement of the channel of Mobile Harbor has been progressive. Between 1826, the date of the first appropriation for this work, and 1857 a channel 10 feet deep was dredged through the shoals in Mobile Bay up to the city of Mobile. Between 1870 and 1876 this depth was increased to 13 feet, the channel being dredged to a width of 300 feet through Choctaw Pass and 200 feet through Dog River bar.

In 1880 a project for a channel 17 feet deep and 200 feet wide was adopted, and appropriations between 1878 and 1886 were applied to the formation of a channel of these dimensions.

In the river and harbor act of August 11, 1888, a project for securing a channel 23 feet deep was adopted, this project being modified by the river and harbor act of September 19, 1890, so as to provide for the formation of a channel 23 feet deep and with a top width of 280 feet from the Gulf of Mexico to the mouth of Chickasaw Creek, above the city of Mobile. Work upon this channel was completed in 1896, subsequent appropriations, up to and including that made by the sundry civil act of July 1, 1898, having been applied to its maintenance.

The total amount expended on these projects was $3,648,630.60, of which about $115,000 is estimated to have been applied to maintenance.

The existing project for the improvement of Mobile Harbor provides for the formation of a channel 23 feet deep and 100 feet wide

at bottom, with appropriate slopes, from the entrance of the bay to the mouth of Chickasaw Creek, at an estimated cost of $1,640,000, and the removal of sunken obstructions from Mobile Harbor at such times as the latter work may be authorized. This project was adopted by the river and harbor act approved March 3, 1899, and was modified by the acts of June 13, 1902, and March 3, 1905.

The work of forming a 23-foot channel in Mobile River and Bay under this project was commenced in 1899, and under two continuing contracts, during the progress of which 12,402,956 cubic yards of material, scow measurement, was removed up to November 11, 1903, an uninterrupted channel of the projected depth and from 55 to 150 feet width was formed within the limits of the project.

After the storm of September 27, 1906, the channel shoaled in places to as little as 17 feet. Under a contract the worst of the shoaling was remedied at a cost of approximately $100,000, 1,109,410 cubic yards of material being removed.

The work of removing sunken trees, logs, timbers, and other dangerous obstructions from the channel of Mobile Harbor has been prosecuted when necessary with funds allotted for that purpose.

The existing project was modified by the river and harbor act of March 2, 1907, so as to include the completion of the work proposed by the existing project at an estimated cost of $560,000, and the prosecution of operations to provide increased depth progressively as may be possible with appropriations of $100,000 annually for a period of five years.

The construction of a dredge was authorized. All of the $560,000 has been appropriated. Of this amount $10,000 was applied to the removal of sunken obstructions from Mobile Harbor, $545,000 was allotted to work of dredging and nearly all so applied, and $5,000 to the preparation of plans for a dredge. It was proposed to apply $200,000 of this money to the construction of a dredge, but the administrative act approved May 28, 1908, contained the following provision:

SEC. 7. That the whole or any part of the amount heretofore authorized to be appropriated for the construction of a dredge for Mobile Harbor, Alabama, with the exception of five thousand dollars for the preparation of plans for said dredge, may be used for dredging said harbor, and the Secretary of War, in his discretion, may enter into a contract or contracts for the performance of the work.

The funds are therefore being applied to dredging, except the $5,000 for dredge plans.

The modification of project is printed in House Document No. 647, Fifty-ninth Congress, first session.

To June 30, 1909, there was expended on the existing project as modified $1,777,528.49, of which $551,166.03 was applied to work of maintenance.

The work of dredging under contract dated July 10, 1907, approaching completion at the end of the last fiscal year, was completed in July, 1908, leaving depths of from 23½ to 25 feet throughout the channel, except where shoaling had occurred in the lower end.

Plans for a dredge were completed.

At the beginning of the fiscal year there was a small amount of dredging to be done to complete the contract then in force, and the

work was finished by the removal of 25,533.4 cubic yards of material over a distance of 3,100 feet between Chickasaw Creek and Beacon 22, in July, 1908.

Under date of February 1, 1909, another contract was made for dredging in Mobile Harbor in the application of the funds mentioned in the administrative act above quoted from, which funds were appropriated by the act of March 4, 1909, and up to June 30, 1909, 74,321 feet of channel was worked over under this contract, removing about 2,145,000 cubic yards of material, the width of cut being from about 85 to about 125 feet, the purpose of the work being to widen the channel sufficiently to afford 23 feet depth for a width of 100 feet at bottom, and to form appropriate side slopes. The location of this work was from Beacon 10–A to Beacon 8, from Beacon 6–A to 1,635 feet south, and from 150 feet south of Beacon 6 to Beacon 2. There is about 8,000 feet of channel yet to be dredged.

At the beginning of the fiscal year there was a small balance available for removing obstructions from the harbor, and with this a little work was done in July, 1908. Work was resumed in April of this year, with an allotment of $10,000 from the river and harbor act of March 3, 1909. The total work during the fiscal year consisted in removing 355 logs, snags, and stumps from that part of the channel needing this work most. Operations are still in progress.

From the river and harbor act of March 3, 1909, there was allotted $100,000 for dredging work in Mobile Harbor.

The funds available will be applied to work of dredging in Mobile Harbor and to the removal of sunken obstructions in maintenance of the improvement. With future appropriations work will be continued under the approved project.

On June 30, 1909, the maximum low-water draft that could be carried over the shoalest part of the dredged channel was between 23 and 24 feet at mean low water. The average range of tide is 1½ feet.

Mobile River is navigable for vessels of about 14 feet draft up as far as its head, 45 miles above Mobile.

Detailed information with reference to the work accomplished under the existing project is contained in the Annual Reports of the Chief of Engineers for 1901, page 1810, and 1904, page 1803. A reference to the report of the survey upon which the project is based is printed in the Annual Report of the Chief of Engineers for 1904, page 324.

The combined commerce, foreign and domestic, using Mobile Harbor during 1908 aggregated 1,838,101 tons, valued at $58,507,433. Cotton, lumber, timber, breadstuffs, and hog products are the principal articles of export, and bananas and sisal grass the most important of imports.

The effect of the project has been to give Mobile an average reduction of about 20 per cent on rail freight rates from Atlantic seaport cities and to afford direct water freight rates from Mobile to foreign ports.

GENERAL IMPROVEMENT.

July 1, 1908, balance unexpended		$160,238.54
June 30, 1909, receipts from sales		408.00
Amount appropriated by sundry civil act approved March 4, 1909		200,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909		100,000.00
		460,646.54
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$100,000.00	
For maintenance of improvement	175,424.50	
		275,424.50
July 1, 1909, balance unexpended		185,222.04
July 1, 1909, outstanding liabilities		74,545.00
July 1, 1909, balance available		110,677.04
July 1, 1909, amount covered by uncompleted contracts		4,000.00
Amount (estimated) required for completion of existing project		77,000.00

REMOVING OBSTRUCTIONS.

July 1, 1908, balance unexpended		$1,413.59
Amount allotted from appropriation by river and harbor act approved March 3, 1909		10,000.00
		11,413.59
June 30, 1909, amount expended during fiscal year, for maintenance of improvement		2,655.25
July 1, 1909, balance unexpended		8,758.34
July 1, 1909, outstanding liabilities		455.00
July 1, 1909, balance available		8,303.34

CONSOLIDATED.

July 1, 1908, balance unexpended		$161,652.13
June 30, 1909, receipts from sales		408.00
Amount appropriated by sundry civil act approved March 4, 1909		200,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909		110,000.00
		472,060.13
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$100,000.00	
For maintenance of improvement	178,079.75	
		278,079.75
July 1, 1909, balance unexpended		193,980.38
July 1, 1909, outstanding liabilities		75,000.00
July 1, 1909, balance available		118,980.38
July 1, 1909, amount covered by uncompleted contracts		4,000.00
Amount (estimated) required for completion of existing project		77,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		210,000.00

Following is the letter of the Chief of Engineers submitting report on a recent survey printed in House Document No. 657, Sixty-first Congress, second session.

OFFICE OF THE CHIEF OF ENGINEERS,
Washington, February 3, 1910.

SIR: I have the honor to submit herewith for transmission to Congress reports dated July 27, 1909, and January 18, 1910, by Maj. Henry Jervey, Corps of Engineers, on preliminary examination and survey, respectively, called for by the river and harbor act approved March 3, 1909, of Mobile Harbor, Alabama, with a view to obtaining a suitable depth and width.

The existing project for improvement of Mobile Harbor provides for a channel 23 feet deep and 100 feet wide on the bottom, with such increased depth as can be secured with appropriations of $100,000 annually after completion; and that for Mobile bar provides for a channel 30 feet deep at low water and 300 feet wide across the bar. Work under these projects is now in progress.

The district officer submits a plan for further improvement contemplating a channel 27 feet deep at mean low water, with bottom widths of 250 feet in the bay and 300 feet in the river; also straightening the channel just below the city of Mobile and providing a turning basin about 600 feet by 800 feet at the upper end of the improvement. He estimates that this work, if done by contract, will cost $2,327,787 for original work and $660,000 for maintenance during construction, making a total cost of $2,987,787. If the work is done with government plant, however, he estimates that it will cost only one-half this amount, or $2,043,893.50, which includes the construction of two dredges, with necessary plant, and he recommends this plan. He is of opinion that a suitable bar channel should be 33 feet deep and 600 feet wide, which can be secured at a cost of $160,000 if done by contract, or $80.000 if done by the government dredge now available.

The division engineer believes that the width of channel throughout the bay should be 300 feet, which would increase the cost of the improvement to $3,460,000 if done by contract, and he is of opinion that this amount should be provided; otherwise he concurs in the views of the district officer.

These reports have been referred to the Board of Engineers for Rivers and Harbors for consideration, and in its opinion a channel 27 feet deep and 200 feet wide in the bay and 300 feet wide in the river, together with the proposed straightening of the channel and construction of the turning basin, would meet the reasonable requirements of navigation. The Board recommends for adoption a project for this work involving dredging and the construction of two dredges. all at an estimated cost of $1,802,548, with $100,000 annually for maintenance.

With reference to the further improvement of Mobile bar, suggested by the district officer, the Board expresses the opinion that the existing project, if fully carried out and maintained, will be sufficient for the needs of navigation in the near future, and that it will not be advisable to provide increased dimensions, at least until work on the Mobile Harbor channel has advanced sufficiently to demonstrate the need of further improvement over the bar.

I concur in the views of the Board of Engineers for Rivers and Harbors.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The following is from the report of the House committee:

Liberal provision, amounting to $450,000, is made for the adoption of the new project for increased depth and width in this harbor in recognition of the increased commerce which is at present laboring under serious disadvantages due to the limited dimensions of the existing channel. The port of Mobile is a logical outlet for the coal and iron of Alabama, and as the improvement of the Warrior and Tombigbee rivers is nearing completion the facilities at Mobile should be put in proper condition to handle the expected traffic. The change in the character of export traffic through the port of Mobile is such as to require the use of ships of deeper draft and the increased depth heretofore provided has been taken full advantage of as rapidly as available. The additional depth now provided for is believed to be an economic necessity in order that vessels carrying the heaviest cargoes of coal and iron with which they can be freighted may leave the port fully ladened. The importance of the completion of this channel at the earliest date is the reason for the provision in the bill that it should be completed within four years.

ALABAMA RIVER, ALABAMA.

This river is formed by the junction of the Coosa and the Tallapoosa, 11 miles below Wetumpka, on the Coosa River, and from this junction to its junction with the Tombigbee to form the Mobile it constitutes a 312-mile link in a waterway 815 miles long, from the Oostenaula and Coosawattee rivers, Georgia, to the Gulf of Mexico.

The river was originally so obstructed by logs, snags, and overhanging trees, and shoals, many with depths of but 2.5 feet, that during the low-water season navigation was practicable by day only. Long detentions were frequent at many of the shoals below Selma, and when the water was unusually low traffic was suspended between Selma and Montgomery for three or four months in the year.

The original project, adopted in 1878, for the improvement of this stream provided for securing a low-water channel 4 feet deep and 200 feet wide by removing snags, logs, and overhanging trees; by constructing works of regulations, and by dredging, all at an estimated cost of $229,741. On this project $185,000 was expended, principally in snagging operations and the construction of works of contraction. These expenditures greatly improved the condition of the channel, freeing it from obstructions, and secured a low-water depth of 4½ to 5 feet.

In 1891 the original project was amended to provide for a low-water channel 6 feet deep, which was to be secured in the same general way as contemplated in the original project, and the estimated cost was placed at $386,251, provided that at least $100,000 should be appropriated annually and $10,000 a year thereafter for maintenance. The project is about 30 per cent completed.

Under this project there has been expended to June 30, 1909, $488,009.09, largely for maintenance, but until recently appropriations have been very small and the channel has been deteriorating, work on the river being confined to the operations of the snag boat. During the last three years the plant has been thoroughly overhauled and materially increased.

The river and harbor act of March 3, 1905, contemplated securing a continuous channel not less than 4 feet deep in the Alabama River by open-channel work, and as the benefits to be derived from the improvement are very great, funds should be provided for the vigorous prosecution of work.

Operations during the year consisted in snagging, dredging, and construction of contraction works at various points.

During the year the maximum draft that could be carried to Montgomery at low water was about 3 feet, but as the boats operating on this river draw from 4 to 6 feet, the boats came only to Selma till high water.

It is proposed to apply the appropriation recommended in snagging, dredging, and construction of contraction works in furtherance of the project and in maintenance of the improvement.

The actual head of navigation at ordinary low water is Wetumpka, on the Coosa River, and the variation of the water level is from 0 to 59 feet at Montgomery.

The commerce of this stream is important, consisting principally of cotton, cotton seed, fertilizers, grain, lumber, shingles, naval stores, staves, and a large quantity of miscellaneous freight of all descriptions, the value of which for the year 1908 is estimated at

$9,000,000. This, however, is but a part of the freight movement that is affected by the improvement, for the actual shipments by water have been relatively small, and, with a river improved for continuous navigation, it is estimated that at least 100,000 tons of the present all-rail freight movement would either go by river or at river rates, and the resulting saving would be very large. In addition, improved facilities would render possible an actual reduction in rates on freight now carried by river.

July 1, 1908, balance unexpended		$170,389.22
Amount allotted from appropriation by river and harbor act approved March 3, 1909		110,000.00
		280,389.22
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$60,000.00	
For maintenance of improvement	64,348.31	
		124,348.31
July 1, 1909, balance unexpended		156,040.91
July 1, 1909, outstanding liabilities		14,975.00
July 1, 1909, balance available		141,065.91
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		90,000.00

ALABAMA AND COOSA RIVERS, ALABAMA.

Report on a recent survey is printed in House Document No. 1089, Sixtieth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, November 13, 1908.

SIR: Under authority conferred by section 3 of the river and harbor act approved March 2, 1907, I have the honor to submit herewith, for transmission to the Public Printer, reports of November 15, 1907, and October 8, 1908, with map, by Capt. H. B. Ferguson, Corps of Engineers, on preliminary examination and survey, respectively, provided for by said act of March 2, 1907, of Alabama and Coosa rivers, between Montgomery and Wetumpka, in the State of Alabama.

Wetumpka, Ala., on the Coosa River, is the logical head of navigation on a waterway 368 miles long and composed of the Coosa, Alabama, and Mobile rivers between that city and Mobile. Mobile River is navigable for vessels of about 14-foot draft throughout its length. The existing project for the improvement of the Alabama River has for its object to obtain, as nearly as possible, a continuous channel of a depth not less than 4 feet by open-channel work. This project was adopted by the river and harbor act of March 3, 1905, and to the present time efforts have been devoted to securing this depth up to the city of Montgomery.

As a result of the present survey, Captain Ferguson estimates that it will cost (in round numbers) $36,000 to extend this 4-foot channel a distance of 28.61 miles from Montgomery through the Alabama and Coosa rivers to Wetumpka, with $5,000 a year for maintenance after completion. This improvement is to be effected by the same method and with the same plant as that employed on the lower Alabama.

I concur in the opinion of the local officer, the present division engineer, Lieut. Col. Lansing H. Beach, Corps of Engineers, and the Board of Engineers for Rivers and Harbors that the locality under consideration is worthy of improvement to the extent indicated.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

Following is an extract from the report of the Board of Engineers:

While the commerce between Montgomery and Wetumpka is small, the river has exercised a beneficial influence in controlling railroad freight rates, and with an improved channel a greater measure of benefits will undoubtedly accrue both from this source and from the increased use of the river for commercial transportation. The practicability of improving this stretch of the river by open-channel methods has heretofore been in doubt, but the information developed by the recent survey discloses more favorable conditions than were believed to exist, and places the question of the improvement of this part of the river in a different light than formerly.

Having in mind the small expenditure involved in the plan now proposed by the district officer, the Board reports that in its opinion the Alabama and Coosa rivers from Montgomery to Wetumpka are worthy of improvement by the United States at the estimated cost of $35,695, and $5,000 annually for maintenance.

BLACK WARRIOR, WARRIOR, AND TOMBIGBEE RIVERS, ALABAMA.

(*a*) *Black Warrior River.*—This name refers to that portion of the Warrior River above Tuscaloosa. Originally this part of the river was practically closed to navigation on account of shoals at and above Tuscaloosa.

The original project for the improvement was adopted in 1887, the object being to obtain a channel for barges of 6 feet draft at low water all the year round between Tuscaloosa and Daniels Creek, 14½ miles above, by means of five locks and dams, at an estimated cost of $741,670.

Locks 10, 11, and 12 were built by hired labor and have been completed and opened for traffic since November, 1895.

Lock No. 13 was completed in May, 1905. The river and harbor act of March 3, 1899, provided for the construction of this lock, and extended the upper limit of the improvement to the junction of the Mulberry and Locust forks of the river, 46½ miles above Tuscaloosa.

The river and harbor act of March 2, 1907, authorized the construction of Locks 14, 15, 16, and 17, leaving Locks 18, 19, and 20 to be provided for. It was subsequently decided to build two 21-foot lift locks (Nos. 16 and 17) instead of three 14-foot lift locks, on Squaw shoals, thus reducing the number of locks in the slack-water system necessary to carry the improvement up to the Mulberry and Locust forks from 20 to 19.

The completion of four locks on this river has resulted in affording 6-foot navigation to the site of Lock 14, from Tuscaloosa, 12 miles. Locks 14 and 15 are being built under contract dated December 23, 1907. These two locks and dams are about 55 per cent completed, and lock-tenders' houses have been built at both locks.

Under date of Novmeber 28, 1908, a contract was made for the construction of Lock and Dam No. 16 and lock-tender's house. Camp houses have been erected, and a railroad is being built to the site of the lock, but actual work on the lock has not yet been commenced.

Gates for Locks 14 and 15 were built during past fiscal year, and are stored at Tuscaloosa shops; valves and special irons completed and delivered at sites; contract work continued through the year, about 50 per cent of the work being accomplished since July 1, 1908; sites for Locks 16 and 17 purchased; plans and specifications prepared for Lock 17, also plans for Locks 18 and 19.

The total amount expended on the Black Warrior River to June 30, 1909, including cost of surveys, etc., was $1,226,383.53, none of which was applied to maintenance.

Recent appropriations have been made for locks and dams on the Black Warrior, Warrior, and Tombigbee rivers as one slack-water system, and for statement of total figures for project see report (*c*) *Tombigbee River.*

The improvement of the Black Warrior River between Tuscaloosa and Daniels Creek is based upon the report of a board of engineers, dated April 2, 1887, and published in the Annual Report of the Chief of Engineers for 1887, page 1302.

For commercial statistics, see report on operating and care of locks and dams, page 423 of this report.

(*b*) *Warrior River.*—This name refers to that portion of the Warrior River below Tuscaloosa. Originally logs, snags, and overhanging trees rendered navigation impossible at low water and dangerous at boating stages. The minimum depth of channel was about 1 foot and the minimum width about 60 feet.

The original project for the improvement, adopted by the river and harbor act approved March 3, 1875, contemplated deepening the channel by jetty construction and the removal of snags and overhanging trees. The amount expended on this project from 1880 until the adoption of the present project was $319,388.30. Prior to 1880 appropriations aggregating $88,000 were expended on the Warrior and Tombigbee rivers jointly, and an account of this work may be found in the Annual Report of the Chief of Engineers for 1897, page 1679.

The present project, adopted by the river and harbor act of March 3, 1899, for the construction of six locks and dams (Nos. 4–9, inclusive, of the Black Warrior, Warrior, and Tombigbee system), with a total lift of 60 feet, and to afford a channel for barges of 6 feet draft at mean low water all the year round between Demopolis and Tuscaloosa, has been completed. The last three locks built (Nos. 4, 5, and 6) were commenced under contract in May, 1903, but after abandonment of work by the contractors on December 31, 1904, they were completed with hired labor and were opened for traffic during the past fiscal year.

The total amount expended on improvement of Warrior River under the existing project to June 30, 1909, was $2,086,445.12, of which $13,691.24 was applied to maintenance.

For commercial statistics, see report on operating and care of locks and dams.

The report of the survey upon which the present project is based is printed in the Annual Report of the Chief of Engineers for 1890.

(*c*) *Tombigbee River from the mouth to Demopolis (construction of locks and dams).*—The original condition of the navigable channel of this section of the river was such as to permit of steamboat navigation during high stages of water only, lasting about six or eight months of the year. The minimum width of the channel was about 100 feet and the minimum depth about 2 feet.

For project, amount expended, etc., see report on maintenance of channel, Tombigbee River from the mouth to Demopolis.

the existing project to June 30, 1909, was $722,033.76; for con-

The amount expended on work of lock and dam construction under struction of dredge, $40,030; and for construction of lock houses, $10,315.16.

The river and harbor act approved March 3, 1905, made an appropriation of $100,000, and provided for the further appropriation of $781,466, to be applied to the completion of Locks and Dams Nos. 1, 2, and 3, Warrior and Tombigbee rivers, Alabama, and of Lock No. 1, Tombigbee River, and the construction of Lock No. 2, Tombigbee River. It was also provided that of these sums $40,000 might be expended for the construction of a dredge and $30,000 for the construction of lock houses necessary for the operation of locks and dams in the Black Warrior, Warrior, and Tombigbee rivers.

The full amount authorized by this river and harbor act was subsequently appropriated. Provision was made in the river and harbor act of March 2, 1907, for the construction of Lock and Dam No. 3.

During the past fiscal year Lock and Dam No. 1 were completed and opened to traffic, with hired labor. At Locks Nos. 2 and 3 work was continued under contract dated December 4, 1907, consisting principally of cleaning and grubbing, building cofferdams, excavation, and delivering materials and plant. Valves and special irons were built at the Tuscaloosa shops and delivered to the contractor at the lock sites. Steel gates for these locks were also built at the same shops and are stored there ready for delivery.

About 16 per cent of the work has been done at Lock No. 2 and about 8 per cent at Lock No. 3.

During the year the 12-inch hydraulic dredge *Humphreys* was completed and is in operation. Contract was made for an additional lock house at Lock No. 2, and it is about 90 per cent completed.

For commerce during the calendar year 1908, see report on Tombigbee River, mouth to Demopolis, and reference is also had to report on operating and care of locks, which furnishes statistics for the fiscal year.

General.—Recent appropriations for slack watering the Black Warrior, Warrior, and Tombigbee rivers have been made for one system of locks and dams, so that this is now considered one project, and work is in progress on the same under continuing contract authorization in river and harbor act of March 2, 1907, of which $312,000 remains to be appropriated. The estimated total cost of this work, exclusive of maintenance, is now $7,393,219.31. The increase in this estimated total cost over that contained in the Annual Report for 1908 is due to the fact that the amounts required for the completion of Locks Nos. 1, 4, 5, and 6, finished during the past fiscal year with hired labor, proved to be considerably larger than had been estimated, especially in the case of the first-named lock, where it was necessary to maintain a heavy force to insure completion of the dam before high water. The closure of the dam was made November 18, 1908. Also, experience has shown that the present type of guard cribs is too light. It is proposed to substitute a crib of wider base at Locks Nos. 1, 2, and 3, Tombigbee River, in place of those originally planned, and to reduce the intervals between successive cribs guarding the upper approaches to these locks, in order to facilitate the handling and entrance of boats.

The following statement shows the total figures for this project:

Total estimated cost of project, including $13,691.24 applied to maintenance of work		$7,406,910.55
Total amount appropriated, received from sales, etc., to June 30, 1909		5,294,910.55
Amount authorized but not appropriated	$312,000	
Amount required, but not yet authorized or appropriated	1,800,000	
		2,112,000.00

The following division shows the proposed application of the required $2,112,000:

For completing all locks and dams	$1,947,000.00
For dredging between locks, necessary to obtain 6-foot depth	100,000.00
For construction of additional lock houses	25,000.00
For removing snags and overhanging trees (original work)	30,000.00
For building fishways in dams at Locks Nos. 7, 8, 9, 10, 11, 12, and 13	10,000.00
Total amount required that has not yet been appropriated	2,112,000.00

The following shows the disposition of the amount appropriated, received from sales, etc., to June 30, 1909, in all		5,294,910.55
Applied to work of lock and dam construction, including surveys	$4,021,171.17	
Cost of dredge	40,030.00	
Cost of lock houses to June 30, 1909	10,315.16	
Snagging work (maintenance)	13,691.24	
Total		4,085,207.57
Balance unexpended June 30, 1909		1,209,702.98

It is therefore proposed to apply available funds and future appropriations to the completion of locks and dams on the Black Warrior and Tombigbee rivers, the performance of dredging, removal of snags and overhanging trees, etc., as indicated in the foregoing statement, the work immediately proposed, however, being the completion of Locks and Dams Nos. 2 and 3, Tombigbee River, and Nos. 14, 15, and 16, Black Warrior River, and the commencement of Lock No. 17, Black Warrior River, all under contract.

The work of lock and dam construction thus far accomplished has had a marked effect on traffic. Through packet service from Mobile to Tuscaloosa, which had been abandoned for many years, was resumed during the past fiscal year, and four towboats, with a number of barges, have been in use on the upper river during the past winter. Just what effect the all-year-round 6-foot navigation will have when obtained can not be definitely stated as yet, but it is expected to cause a great reduction in freight rates between the mining section of Alabama and the Gulf of Mexico.

LOCKS AND DAMS.

July 1, 1908, balance unexpended	$807,031.47
June 30, 1909, receipts from sales	575.42
Amount appropriated by sundry civil act approved March 4, 1909	1,000,000.00
	1,807,606.89
June 30, 1909, amount expended during fiscal year, for works of improvement	[a]617,588.75

[a] Not including $12.50 expended for United States Weather Bureau and subsequently returned to appropriation; also not including $65.47 expended for Isthmian Canal Commission, to be returned to appropriation.

July 1, 1909, balance unexpended	$1,190,018.14
July 1, 1909, outstanding liabilities	61,300.00
July 1, 1909, balance available	1,128,718.14
July 1, 1909, amount covered by uncompleted contracts	1,398,408.00
Amount (estimated) required for completion of existing project	2,112,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	[a]1,100,000.00

LOCK HOUSES.

July 1, 1908, balance unexpended	$19,684.84
July 1, 1909, balance unexpended	19,684.84
July 1, 1909, amount covered by uncompleted contracts	1,792.00

CONSOLIDATED.

July 1, 1908, balance unexpended	$826,716.31
June 30, 1909, receipts from sales	575.42
Amount appropriated by sundry civil act approved March 4, 1909	1,000,000.00
	1,827,291.73
June 30, 1909, amount expended during fiscal year, for works of improvement	617,588.75
July 1, 1909, balance unexpended	1,209,702.98
July 1, 1909, outstanding liabilities	61,300.00
July 1, 1909, balance available	1,148,402.98
July 1, 1909, amount covered by uncompleted contracts	1,400,200.00
Amount (estimated) required for completion of existing project	2,112,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	[a]1,100,000.00

The House Committee in its report says:

The improvement of the Warrior and Tombigbee rivers has for its object furnishing an outlet for the coal fields of Alabama. Since the adoption of the present project in 1902 work has been prosecuted energetically, and at the present time there are four locks and dams under construction, an additional site has been procured, the plans and specifications for its construction prepared, and the provision carried in the present bill is necessary to put this lock under contract and prevent suspension of active operation on the project. The amount appropriated and authorized will be sufficient to provide for completing four locks now under construction, placing Lock 17 under contract and doing the necessary preliminary work, including the purchase of lock sites, for the construction of Locks 18 and 19, necessary for the completion of the project. Locks 2 and 3, now under construction, are on the Tombigbee River, near Mobile; Locks 15 and 16, on the Upper Warrior, and those remaining to complete the project are, as above indicated, Nos. 17, 18, and 19. The system includes 19 locks designed to provide for a 6-foot barge navigation. No others are contemplated in the present project, which reaches the lower Alabama coal fields. However, an examination was provided for in the act approved March 3, 1907, for a further investigation, which may indicate the desirability of additional locks to extend the improvement farther into these coal fields.

[a] Of this amount $312,000 is for continuing contract work authorized by the river and harbor act of March 2, 1907.

TOMBIGBEE RIVER FROM THE MOUTH TO DEMOPOLIS (MAINTENANCE OF CHANNEL).

The original condition of the channel of this portion of the river was such as to permit of steamboat navigation during high-water stages only, lasting about six or eight months of the year. The minimum width of the channel was about 100 feet and the minimum depth 2 feet, at mean low water.

The original project for the improvement of this stream, as adopted in 1871, contemplated the removal of snags and other obstructions in the channel of the river and the widening and deepening of the existing channel through various shoals, at an estimated cost of $21,500. The project adopted in 1879 was to afford a channel of navigable width and 4 feet deep at ordinary low water from the mouth to Demopolis, a distance of 185 miles, by the removal of snags, logs, and overhanging trees, and the improvement of the worst bars by dredging.

Prior to commencement of work under the existing project there was applied to channel work on this section of river $249,542.48.

The earlier projects for the improvement of this section of Tombigbee River were superseded by the project adopted in the river and harbor act of September 19, 1890. The project adopted at that time provided for securing a channel 6 feet deep at low water between the mouth and Demopolis by the construction of locks and dams and bank revetments, and by the removal of logs, snags, and other obstructions. The cost of this project was originally estimated at $508,808.98, but in 1897, after $330,000 had been appropriated for the work, the estimate was increased, the additional cost of completion being then placed at $600,000.

By the river and harbor act of June 13, 1902, the formation of a 6-foot channel below Demopolis by constructing locks and dams was made a part of the project for securing 6-foot navigation in the Black Warrior, Warrior, and Tombigbee rivers, Alabama. Information in regard to work accomplished on the Tombigbee River under this project and the expenditures made in connection therewith will be found in the section of this report immediately preceding.

Under previous projects this section of the Tombigbee River has been repeatedly cleared of snags, dikes have been constructed, dredging has been done at the worst bars, and the channel made navigable for steamboats at low stages of the river. The existing project for maintenance of the improvement of the Tombigbee River from the mouth to Demopolis was adopted by the river and harbor act of June 13, 1902, and contemplates the maintenance of the existing channel by the removal of logs, snags, and other obstructions from the stream, and by the repair of dikes.

The amount expended on work under the existing project up to the close of the fiscal year ending June 30, 1909, was $51,332.17, all of which was applied to maintenance. All work under this project has been performed with the United States plant and hired labor, and the channel of the stream has been maintained in a navigable condition.

During the past fiscal year the snag boat *Demopolis* worked over about 16½ miles of this section, below Lock No. 1, removing 1,028 obstructions from the channel and doing a small amount of bank work. In addition, the wreck of an old sunken snag boat was removed.

The new snag boat *Tombigbee* was received and fitted up, and will commence work as soon as the water falls low enough. Part payment for this boat was made from this appropriation, and part cost of completing dredge for use on this and other rivers was also paid.

It is proposed to apply available funds and future appropriations to maintenance of the improvement by snagging, dredging, and construction of jetties. Two snag boats will be kept at work here.

The Tombigbee River is navigable for steamboats as far up as Columbus, Miss., a distance of 341 miles above its mouth, and for rafts as far up as Walkers Bridge, Miss., a farther distance of 169 miles. This stream is nontidal except in its lower reaches. Floods at Demopolis rise at times to a stage of 60 feet above low water.

Commerce on this section of river in 1908 amounted to 300,081 tons, valued at about $4,529,739. The project results in affording cheap water rates between Mobile and points along the lower Tombigbee River.

July 1, 1908, balance unexpended	$21,933.13
June 30, 1909, receipts from sales	137.80
Amount allotted from appropriation by river and harbor act approved March 3, 1909	10,000.00
	32,070.93
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	22,416.30
July 1, 1909, balance unexpended	9,654.63
July 1, 1909, outstanding liabilities	1,304.00
July 1, 1909, balance available	8,350.63
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	26,000.00

TOMBIGBEE RIVER FROM DEMOPOLIS, ALA., TO COLUMBUS, MISS.

The original condition of this section of the river was such as to amit navigation only during high-water stages. The channel was obstructed by shoals, logs, and overhanging trees, the minimum depth being 1 foot at mean low water, and the minimum width of channel 70 feet. The improvement of the Tombigbee River between Demopolis and Columbus was commenced under the project of 1871, which contemplated the improvement of this stream by the removal of snags and other obstructions in the river and the widening and deepening of existing channels through various bars. In 1879 this project was modified so as to provide for the formation of a channel of navigable width and 3 feet deep at low water from Demopolis to Columbus, this section forming a part of two different improvements.

Prior to adoption of the present project, $63,382.98 was expended on this section of the river.

The present project for improvement of this section of Tombigbee River, adopted in 1890, provides for securing a channel 6 feet deep at low water from Demopolis to Columbus, a distance of 156 miles, by snagging, tree cutting, bank revetment, bar improvement, and the construction of locks and dams, at a cost originally estimated at $779,400. In 1897 the construction of locks and dams was estimated

to cost $2,000,000. This project was adopted by the river and harbor act of September 19, 1890, but no provision has yet been made by Congress for commencing the work of lock and dam construction. The fall of the river from Columbus to Demopolis is about 108 feet.

The total amount expended on the work under the existing project up to the close of the fiscal year ending June 30, 1909, was $178,295.38, of which about $77,838.49 was applied to maintenance. These expenditures have resulted in the formation of a clear channel within the limits of the project available for light-draft boats on a 2-foot rise above low water and in the partial maintenance of this improvement. Work has been prosecuted by means of United States plant and hired labor.

During the fiscal year about 68 miles of river were worked over with the snag boat *Vienna* upstream from Demopolis, when interrupted by high water. Overhanging trees were cut and pulled back, and 1,588 logs, snags, and stumps were removed from the channel. This part of the river can be navigated by steamboats most of the year.

For efficient work on this section, a self-propelling snag boat is considered necessary, and the cost of such a boat has been included in estimate of amount required.

It is proposed to apply available funds and future appropriations to the work of maintaining the improvement by the removal of snags, trees, and other obstructions brought into the channel by freshets. The maximum height of these freshets at Columbus is 40 feet.

The commerce on this section of the river for the calendar year 1908 amounted to about 15,202 tons, valued at $531,128.

This project results in affording water rates from Mobile to points on the Tombigbee River above Demopolis for several months each year.

July 1, 1908, balance unexpended	$9,687.94
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	5,983.32
July 1, 1909, balance unexpended	3,704.62
July 1, 1909, outstanding liabilities	570.00
July 1, 1909, balance available	3,134.62
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	26,000.00

TOMBIGBEE RIVER FROM COLUMBUS TO WALKERS BRIDGE, MISS.

Prior to 1902 this improvement was divided into two sections, one from Columbus to Fulton, 144 miles, and the other from Fulton to Walkers Bridge, 25 miles, for which appropriations were made separately.

The original condition of the river was such that navigation was impossible except at high water, and difficult even at that stage, owing to the logs, snags, and overhanging trees which obstructed the channel. The minimum depth in the channel was about 1 foot at mean low water and the minimum width was 50 feet.

The project for the improvement of the river above Columbus was adopted in 1873, and provided for obtaining a good high-water chan-

nel by the removal of obstructions, at an estimated cost of $35,000. This project was completed in 1882, at a cost of $27,293.65, since which time operations have been directed toward maintaining the improvement. The first specific appropriation for the portion of the river between Fulton and Columbus was made in 1892, this money, together with subsequent appropriations, being applied to the maintenance of a high-water channel.

The project for improvement of the river from Fulton to Walkers Bridge was adopted in 1888, and provides for securing a high-water channel by the removal of logs, snags, and overhanging trees, at an estimated cost of $11,000, and for the maintenance of the same at an annual cost of $1,500. This project was adopted by the river and harbor act of August 11, 1888, and was completed in 1891 at a cost of $6,517.19.

The total amount expended on these projects up to the close of the fiscal year ending June 30, 1909, was $77,725.20, of which amount $43,914.36 had been applied to maintenance. United States plant and hired labor have been employed on this work.

The limited amount available for work on this section of the river for a nmber of years has limited operations to short stretches of river in worst condition, but it is desired to make the operations more extensive, maintaining two working parties in the field instead of one, with a view to getting over the entire section in one working season.

During the past fiscal year no work could be done until June 17, 1909, owing to lack of money. On this date work was commenced just below Fulton, Miss., working downstream. About 18 miles of river was worked over during the balance of the month, though the river was a little too high for thorough work and parts of this stretch may have to be worked over again at a lower stage; 102 obstructions were removed from the river, in addition to bank work. These operations are being carried on with funds allotted from the appropriation of March 3, 1909.

As a result of the work done on this section of Tombigbee River it has been possible to bring large rafts of logs and timber down on a rise of a few feet above low water, but the freshets here range from 20 to 40 feet during the high-water season and many obstructions are brought into the stream by these floods, rendering it necessary to remove such obstructions each season in order to keep the channel open. This part of the river is nontidal.

It is proposed to apply available funds and future appropriations to the work of maintaining a high-water channel within the limits of the improvement.

A reference to reports on surveys upon which a portion of this project is based is printed in the Annual Report of the Chief of Engineers for 1905, page 340.

The commerce on this section of the river during the calendar year ending December 31, 1908, amounted to 22,834 tons of logs, valued at $120,181.

Funds for work on this part of the river are allotted from the appropriation for Tombigbee River, Demopolis to Columbus.

This project has no effect on freight rates.

July 1, 1908, balance unexpended	$71.14
Amount allotted from appropriation by river and harbor act approved March 3, 1909	3,000.00
	3,071.14
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	129.29
July 1, 1909, balance unexpended	2,941.85
July 1, 1909, outstanding liabilities	330.00
July 1, 1909, balance available	2,611.85
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

HARBOR AT BILOXI, MISS.

This channel originally had a minimum depth of 4 feet. The original project for its improvement was adopted in 1882 and contemplated the formation of a channel through Deer Island flats to connect Biloxi Bay with the Back Bay of Biloxi, at an estimated cost of $35,000. The channel thus proposed was to have a depth of 8 feet at low water with a width sufficient for navigation.

In 1884 this project was changed so as to provide for deepening the channel from Mississippi Sound to the wharves at Biloxi from the existing depth of 4 or 4½ feet to 8 feet over a width of 150 feet, the estimated cost of this work being $55,000. The work of dredging was commenced in September, 1887, and the project was finally completed in August, 1893, at a cost of $44,382.27.

Since that time funds have been applied to the maintenance of the improvement.

No work was done here during the past fiscal year, the expenditures being in payment of part cost of building new hull for U. S. S. *Chickasaw*, and some travel expenses incurred while inspecting the improvement. The last dredging at this locality was completed in May, 1908, and considerable shoaling, especially near the edges of channel, has taken place since.

Available funds and future appropriations will be applied to maintaining a channel 8 feet deep and as great a width as possible, not exceeding 150 feet.

The commerce of the harbor during the calendar year 1908 consisted principally of lumber, rosin and turpentine, fish and oysters, and general merchandise, amounting to 217,550 tons, valued at $2,361,150.

The total amount expended on this improvement up to June 30, 1909, was $71,586.44, of which $27,204.17 was applied to work of maintenance.

The maximum low-water draft that can be carried through the channel is now about 8 feet, and the range of tide is about 1¾ feet.

The project has little or no effect on freight rates.

July 1, 1908, balance unexpended	$1,298.61
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	502.78
July 1, 1909, balance unexpended	795.83
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

nel by the removal of obstructions, at an estimated cost of $35,000. This project was completed in 1882, at a cost of $27,293.65, since which time operations have been directed toward maintaining the improvement. The first specific appropriation for the portion of the river between Fulton and Columbus was made in 1892, this money, together with subsequent appropriations, being applied to the maintenance of a high-water channel.

The project for improvement of the river from Fulton to Walkers Bridge was adopted in 1888, and provides for securing a high-water channel by the removal of logs, snags, and overhanging trees, at an estimated cost of $11,000, and for the maintenance of the same at an annual cost of $1,500. This project was adopted by the river and harbor act of August 11, 1888, and was completed in 1891 at a cost of $6,517.19.

The total amount expended on these projects up to the close of the fiscal year ending June 30, 1909, was $77,725.20, of which amount $43,914.36 had been applied to maintenance. United States plant and hired labor have been employed on this work.

The limited amount available for work on this section of the river for a nmber of years has limited operations to short stretches of river in worst condition, but it is desired to make the operations more extensive, maintaining two working parties in the field instead of one, with a view to getting over the entire section in one working season.

During the past fiscal year no work could be done until June 17, 1909, owing to lack of money. On this date work was commenced just below Fulton, Miss., working downstream. About 18 miles of river was worked over during the balance of the month, though the river was a little too high for thorough work and parts of this stretch may have to be worked over again at a lower stage; 102 obstructions were removed from the river, in addition to bank work. These operations are being carried on with funds allotted from the appropriation of March 3, 1909.

As a result of the work done on this section of Tombigbee River it has been possible to bring large rafts of logs and timber down on a rise of a few feet above low water, but the freshets here range from 20 to 40 feet during the high-water season and many obstructions are brought into the stream by these floods, rendering it necessary to remove such obstructions each season in order to keep the channel open. This part of the river is nontidal.

It is proposed to apply available funds and future appropriations to the work of maintaining a high-water channel within the limits of the improvement.

A reference to reports on surveys upon which a portion of this project is based is printed in the Annual Report of the Chief of Engineers for 1905, page 340.

The commerce on this section of the river during the calendar year ending December 31, 1908, amounted to 22,834 tons of logs, valued at $120,181.

Funds for work on this part of the river are allotted from the appropriation for Tombigbee River, Demopolis to Columbus.

This project has no effect on freight rates.

July 1, 1908, balance unexpended	$71.14
Amount allotted from appropriation by river and harbor act approved March 3, 1909	3,000.00
	3,071.14
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	129.29
July 1, 1909, balance unexpended	2,941.85
July 1, 1909, outstanding liabilities	330.00
July 1, 1909, balance available	2,611.85
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

HARBOR AT BILOXI, MISS.

This channel originally had a minimum depth of 4 feet. The original project for its improvement was adopted in 1882 and contemplated the formation of a channel through Deer Island flats to connect Biloxi Bay with the Back Bay of Biloxi, at an estimated cost of $35,000. The channel thus proposed was to have a depth of 8 feet at low water with a width sufficient for navigation.

In 1884 this project was changed so as to provide for deepening the channel from Mississippi Sound to the wharves at Biloxi from the existing depth of 4 or 4½ feet to 8 feet over a width of 150 feet, the estimated cost of this work being $55,000. The work of dredging was commenced in September, 1887, and the project was finally completed in August, 1893, at a cost of $44,382.27.

Since that time funds have been applied to the maintenance of the improvement.

No work was done here during the past fiscal year, the expenditures being in payment of part cost of building new hull for U. S. S. *Chickasaw*, and some travel expenses incurred while inspecting the improvement. The last dredging at this locality was completed in May, 1908, and considerable shoaling, especially near the edges of channel, has taken place since.

Available funds and future appropriations will be applied to maintaining a channel 8 feet deep and as great a width as possible, not exceeding 150 feet.

The commerce of the harbor during the calendar year 1908 consisted principally of lumber, rosin and turpentine, fish and oysters, and general merchandise, amounting to 217,550 tons, valued at $2,361,150.

The total amount expended on this improvement up to June 30, 1909, was $71,586.44, of which $27,204.17 was applied to work of maintenance.

The maximum low-water draft that can be carried through the channel is now about 8 feet, and the range of tide is about 1¾ feet.

The project has little or no effect on freight rates.

July 1, 1908, balance unexpended	$1,298.61
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	502.78
July 1, 1909, balance unexpended	795.83
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

HARBOR AT GULFPORT AND SHIP ISLAND PASS, MISSISSIPPI.

Originally no channel existed between Ship Island Harbor and Gulfport, Miss. The depths on the site of the channel ranged from 19 to 8½ feet, and over the site of the anchorage basin they varied from 8½ to 2½ feet, at mean low water.

The existing project was adopted by the river and harbor act of March 3, 1899, which authorized the Secretary of War to enter into contract for dredging a channel 300 feet wide and 19 feet deep at mean low water from the anchorage basin at Ship Island Harbor, on the Gulf of Mexico, to Gulfport, Miss., and to construct at the end of this channel next to the shore an anchorage basin of similar depth and not less than 2,640 feet by 1,320 feet in area. This act also authorized the Secretary of War to contract for the maintenance of this channel and anchorage basin for a term of five years after their completion for the sum of $10,000 annually.

Contract was entered into in 1901 for dredging the channel and anchorage basin, the work to be completed within two years from April 21, 1901, for $150,000, and for the maintenance of the channel and basin for a term of five years after completion for the sum of $10,000 per annum. Work was commenced on April 16, 1901. By joint resolution of Congress approved June 14, 1906, it was provided that the channel and basin should be accepted as dredged, and that $150,000 should be paid the contractor for the work, the channel and basin having been dredged to the approximate depth and width required in the contract. The payment was made. The period of maintenance commenced June 14, 1906.

The river and harbor act approved March 2, 1907, appropriated $100,000 for continuing the improvement and maintenance of the anchorage basin at Gulfport and channel therefrom to the anchorage or roadstead at Ship Island, also Ship Island Pass between Ship and Cat islands, Mississippi, and authorized the Secretary of War to annul that portion of the contract entered into February 20, 1901, with Spencer S. Bullis, relating to the maintenance of a channel and anchorage basin between Ship Island and Gulfport. The annulment of this contract was effected by a supplemental agreement approved by the Secretary of War June 11, 1907.

The report of the survey upon which the improvement of Gulfport Harbor and Ship Island Pass, Mississippi, was originally based is printed in the Annual Report of the Chief of Engineers for 1899, page 1787. Reports of another reexamination and survey of this locality are printed in House Document No. 184, Fifty-ninth Congress, second session.

Prior to the act of March 2, 1907, appropriations were made separately for Gulfport Harbor, Mississippi, and Ship Island Pass, Mississippi. Under an appropriation of $40,000, carried by the river and harbor act of March 3, 1899, the channel through Ship Island Pass was dredged from its original depth of 21 feet to the projected depth of 26 feet and 300 feet width. These depths were 20 feet and 25 feet, respectively, referring to present datum.

The channel through Ship Island Pass has shoaled to as little as 22 feet in some spots. None of the funds appropriated March 2, 1907, were applied to this part of the work.

Of the $170,000 provided by the river and harbor act of March 3, 1909, for Gulfport Harbor and Ship Island Pass, it is proposed to apply $160,000 to maintenance work in the Gulfport channel and basin, and $10,000 to similar work at Ship Island Pass, using the dredge *Barnard* for the former work and the dredge *Charleston* for the latter. Future appropriations will be similarly applied.

During the past fiscal year the *Barnard* was employed most of her time on the work at Gulfport, removing 1,589,620 cubic yards of material, place measurement, from the channel. This dredge and attendant plant was maintained in good repair. The gross cost of the work of the *Barnard*, including repairs to plant, inspection, etc., was $59,128.79, or 3.72 cents per cubic yard.

Part of cost of repairing the *Charleston* was paid from Ship Island Pass funds.

The channel and basin at Gulfport have been maintained at projected dimensions, except in some spots where the depth is less than 19 feet, but the material composing the bottom is soft and vessels drawing 20 feet navigate the channel at mean low water, and those drawing as much as 22 feet use it at high tide. The range of the tide is about 1¾ feet.

During the time dredging work was in progress under contract with Spencer S. Bullis, allotments amounting to $24,199.85 were made from the permanent indefinite appropriation, act July 5, 1884, to cover the expenses of inspection, superintendence, and surveys. Of the amount allotted, $22,449.76 was applied to the purpose for which intended and the balance turned back into the Treasury.

The commerce of Gulfport Harbor and Ship Island Pass during the calendar year 1908 amounted to 473,327 tons, principally lumber, naval stores, and cotton, valued at $5,684,500.

This project results in effecting a reduction in rail freight rates between Gulfport and seaboard cities of the Atlantic coast and in affording water freight rates from Gulfport to foreign ports.

The total amount expended on this improvement to June 30, 1909, was $338,541.42, of which $132,645.69 was applied to maintenance. Of the above amount, $297,711.69 was applied to Gulfport harbor and channel and $40,829.73 was used on Ship Island Pass.

July 1, 1908, balance unexpended	$28,866.86
June 30, 1909, receipts from sales	101.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	170,000.00
November 9, 1908, allotted from emergency appropriation act, of March 2, 1907	10,000.00
	208,967.86
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	60,262.64
July 1, 1909, balance unexpended	148,705.22
July 1, 1909, outstanding liabilities	10,500.00
July 1, 1909, balance available	138,205.22
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	129,000.00

HORN ISLAND PASS, MISSISSIPPI.

The channel through the bar had before improvement a depth which increased through natural causes from 14 or 15 feet in 1853 to about 18 feet in 1886, and has been available at low water since the latter date for vessels up to a draft of slightly less than 18 feet at mean low water.

Under the appropriations for improving Pascagoula River, Mississippi, carried by the river and harbor acts of August 18, 1894, and June 3, 1896, provision was made for the removal of the bar in Horn Island Pass, and in conformity with this provision a channel with a least depth of 20.5 feet (19.5 feet referred to the existing datum), and with a width of 200 feet, was dredged through the Horn Island bar. The total cost of this work was $7,682.40, but the benefit of the improvement was soon lost through shoaling.

Under the appropriations for Pascagoula River and Horn Island Harbor carried by the river and harbor act of March 3, 1899, and the sundry civil act of June 6, 1900, an amount estimated at about $88,000 was applied to dredging a 20-foot (19 feet present datum) channel at certain shoal areas in the Horn Island anchorage basin, the work being in progress between 1899 and 1901.

The existing project for the improvement of Horn Island Pass provides for the formation of a channel 21 feet deep at low water, 300 feet wide through the outer bar, and 200 feet wide elsewhere in the pass, at an estimated cost of $40,480, and $9,000 annually to preserve the improvement. The project was adopted by the river and harbor act of March 3, 1905, which carried an appropriation of $40,480 for the work, subject to the condition "that a contract or contracts can be made at a sum not to exceed the unit price of 11 cents per cubic yard, or such work can be performed by a government dredge."

The proposed dredging work was advertised under date of May 16, 1905, but no bids for its execution were received in response to this advertisement. Since that date the work has been performed by the U. S. dredge *Charleston*, completing the project and maintaining the same.

No work has been done at Horn Island Pass during the past fiscal year, the last work being in April, 1908. The expenditures have been applied in part payment for extensive repairs to the *Charleston*, which dredge will be used during part of the ensuing fiscal year in removing shoals that have formed in Horn Island Pass since the last work done here in maintenance of the improvement. A small amount of office and engineering expenses have also been paid from this appropriation.

Available funds and future appropriations will be applied to maintenance of the present channel through the pass, including part cost of keeping in repair United States dredge for use on this and other outer bars in the district.

The report upon which this project is based is printed in the Annual Report of the Chief of Engineers for 1904, page 1863.

The available low-water depth through the pass is about 21 feet, and the average range of tide is about 1.1 feet.

Commerce using the Horn Island Pass channel during the calendar year 1908 amounted to about 500,836 tons of lumber and timber, valued at about $4,526,960.

This improvement in connection with the improvement of Pascagoula River results in effecting a reduction in rail freight rates between Scranton, Miss., and seaboard cities of the Atlantic coast, and in affording direct water freight rates on lumber from Moss Point and Scranton to foreign ports.

The total amount expended under the existing project up to June 30, 1909, was $50,249.71, of which about $9,768.71 has been applied to maintenance.

July 1, 1908, balance unexpended	$3,493.43
Amount allotted from appropriation by river and harbor act approved March 3, 1909	12,000.00
	15,493.43
June 30, 1909, amount expended during fiscal year for maintenance of improvement	4,263.14
July 1, 1909, balance unexpended	11,230.29
July 1, 1909, outstanding liabilities	2,000.00
July 1, 1909, balance available	9,230.29
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	9,000.00

EAST PEARL RIVER, MISSISSIPI AND LOUISIANA.

At a distance of about 40 miles from its mouth Pearl River divides into two forks, one of which, known as West Pearl River, empties into the Rigolets, while the other, known as East Pearl River, empties into Lake Borgne at Lookout. While the commerce of Pearl River is carried via West Pearl River, through which the water flows at ordinary stages, it appears that within the country tributary to the navigable portion of East Pearl River, extending up to Gainesville, a distance of about 22 miles from the mouth, there originates a commerce of some importance, consisting of export timber, naval stores, canned oysters, etc. Statistics furnished by interested parties indicate that this commerce amounted to about 94,367 tons in 1905, and 192,218 tons in 1906.

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 328, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., December 2, 1907.

Respectfully returned to the Chief of Engineers, U. S. Army.

As stated in the report on preliminary examination, the channel of East Pearl River is of sufficient depth to accommodate any vessels that can navigate Lake Borgne, namely, 9 feet, but the entrance to the river is obstructed by a bar over which there is only 7½ feet at mean low tide. In the within report the district officer estimates the cost of dredging channels 200 feet and 300 feet wide, both having a depth of 9 feet, at $34,000 and $47,000, respectively, and recommends the channel having a width of 200 feet, the estimated annual cost of maintenance being $6,000.

Inviting attention to the statement of the commerce of this stream contained in the Board's report reviewing that of the district officer on the preliminary examination, the Board is of the opinion that the cost of the proposed improvement is reasonable when compared with the benefits which it will probably afford, and it therefore concurs with the district officer and the division engineer in recommending the adoption of the project contained within for restoring through the bar at the mouth of East Pearl River a channel 200 feet wide and 9 feet deep, at an estimated cost of $34,000.

PASCAGOULA RIVER, MISSISSIPPI.

Before this improvement was commenced the channel through the bar at the mouth of the river had a least depth of 3 feet at mean low water, while inside the mouth for a distance of 10 miles upstream the river was navigable for vessels of 6½ feet draft. Appropriations for this work of improvement were made in 1827, 1828, and 1852, but there is no record of the work accomplished with those funds.

The first extended project for the improvement of this stream was adopted in 1880 and contemplated securing a channel 7 feet deep and 200 feet wide across the bar at the mouth of the river. This project also included some snagging work on the river above Moss Point, which is described in the report on the improvement of the Pascagoula, Leaf, and Chickasahay rivers, Mississippi. The project for a 7-foot channel was practically completed in 1884, the total amount expended in securing such a channel, including the appropriations made between 1827 and 1852, amounting to $74,500.

In 1886 a new project was adopted, which provided for securing a channel 12 feet deep at low water, with a navigable width between Mississippi Sound and Moss Point. Under this project a depth of 9 feet across the entrance bar was first obtained, while subsequently a channel 12 feet deep and 80 feet wide was dredged from Moss Point to the mouth of the river, and a 12-foot channel across the bar at the mouth was partially completed. These operations required the expenditure of $95,000, including the expenditure of about $8,000 applied to dredging work in Horn Island Pass in 1897, or a total of $169,500 under both projects.

The present project for the improvement of Pascagoula River was adopted in the river and harbor act of March 3, 1899, and provided for the formation of a 12-foot channel from a point in Dog River 3 miles above its mouth down the Pascagoula River to the 12-foot contour in Mississippi Sound, 150 feet wide above and 300 feet wide below the railroad bridge at Scranton, Miss., at an estimated cost of $317,600, including the formation of a 20-foot channel through certain shoal spots in the Horn Island anchorage.

Work under this project was in progress between September, 1899, and February, 1902, during which time an uninterrupted 12-foot channel was obtained within the limits of the project in Pascagoula River, while a 20-foot channel was formed through the shoal areas in Horn Island anchorage.

The river and harbor act of June 13, 1902, modified and extended the existing project so as to provide for a channel 17 feet deep instead of 12 feet from 3 miles above the mouth of Dog River to Mississippi Sound, at a total cost of $1,050,222, exclusive of the Horn Island improvement.

The total amount expended on the existing project up to the close of the fiscal year ending June 30, 1909, was $674,651.13, excluding the expenditure of about $88,000 on the work performed at Horn Island. Of this amount $155,081.14 was applied to maintenance. Work under the project is about 60 per cent completed.

During the past fiscal year contract work was carried on here, removing 442,556 cubic yards of material from about 22,579 feet of channel, and dredging operations were also carried on with the U. S.

dredge *Barnard*, this dredge removing 586,353 cubic yards of material from 12,647 feet of channel, all dredging being to more than 17 feet depth at mean low water. About one-fourth of this work was original dredging and the balance for the purpose of maintenance.

The available draft is now 18 feet at mean low water. The average range of tide is 1¼ feet.

It is proposed to apply the available balance and future appropriations toward the completion of the project and maintenance of the improvement.

The commerce of the harbor for the calendar year 1908 amounted to 1,184,569 tons, principally logs, lumber, and naval stores, valued at $7,216,460.

This project results in effecting a reduction in rail freight rates between Scranton, Miss., and seaboard cities of the Atlantic coast, and also in affording direct water freight rates on lumber from Moss Point and Scranton to foreign ports.

July 1, 1908, balance unexpended		$125,607.33
Amount allotted from appropriation by river and harbor act approved March 3, 1909		75,000.00
		200,607.33
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$30,622.00	
For maintenance of improvement	90,036.46	
		120,658.46
July 1, 1909, balance unexpended		79,948.87
Amount (estimated) required for completion of existing project		330,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		100,000.00

The following report of the Board of Engineers on a recent survey of Dog River, in which the Chief of Engineers concurs, is printed in House Document No. 642, Sixty-first Congress, second session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., January 17, 1910.

Respectfully returned to the Chief of Engineers, U. S. Army.

This stream has been improved by the United States in connection with the improvement of Pascagoula River, of which it is a tributary. The existing project, adopted in 1899 and modified in 1902, provides for a channel 17 feet deep from a point in Dog River about 3 miles above its mouth to Mississippi Sound, having a width of 150 feet above the railroad bridge at Scranton and 300 feet below.

Above the upper limit of the existing project are two important lumber mills and a number of smaller mills which contribute to the commerce of the stream an aggregate of about 20,000,000 feet of lumber annually. The improvement now desired and for which the district officer submits an estimate of $8,000, is the extension of this 17-foot channel to a point one-fourth of a mile above the Denney and Company railroad bridge, which will afford better shipping facilities for the commerce mentioned above, and will also afford increased water front for the location of additional terminal facilities if needed in the future. He estimates maintenance at 5 per cent of original cost.

Having in mind the small cost of the work involved, the Board concurs with the district officer and the division engineer in the opinion that the locality is worthy of improvement to the extent stated, and it recommends that the project for the improvement of this stream be modified accordingly.

In his report on survey the district officer has given consideration to the question of terminal facilities, and attention is respectfully invited to his remarks on this subject contained within. In the opinion of the Board there are no questions of water power, or other related subjects which could be advantageously coordinated with the project herein recommended, in the interests of commerce and navigation.

PASCAGOULA, LEAF, AND CHICKASAHAY RIVERS, MISSISSIPPI.

(*a*) *Pascagoula River* (*above the mouth of Dog River*).—Before this improvement was commenced navigation was impossible on this section of Pascagoula River except during periods of high water. The minimum width of the channel was 60 feet and the minimum depth was 1 foot at mean low water, the stream being very much obstructed by snags and logs. The first project for this improvement, which was adopted in 1880, in addition to providing for dredging work at the mouth of the stream, described in the report on the improvement of Pascagoula River, Mississippi, contemplated the improvement of the river by the removal of snags and overhanging trees. Under this project the river was cleared of obstructions between 1882 and 1884, at a cost of $15,000. In 1886 the existing project for this improvement was adopted. This project provided for the maintenance of the channel above the mouth of the river by removal of obstructions from the stream from time to time, but was modified in 1899, the extent of the improvement being limited at that time to the section of the river above Dog River, about 100 miles. The total amount expended on the existing project to June 30, 1909, was $29,380.97, all of which was applied to maintenance.

No work was done on the river during the past fiscal year, the expenditures being in payment of part of the cost of a new stern-wheel snag boat and of a small amount of office expenses. The new snag boat built will be occupied most of its time on the Tombigbee River, where she is operating now, and while she can be operated on Pascagoula River she is not suitable for the work on Leaf and Chickasahay rivers. So it is proposed to apply available funds and those estimated for fiscal year 1911 for the Pascagoula, Leaf, and Chickasahay rivers (see consolidated money statement) to the construction of a small self-propelling snag boat especially suited to the work on these three rivers, and to the operation of this boat in maintenance of the improvement. This, it is considered, will be much the most economical and efficient plan for maintaining the three channels.

On June 30, 1909, the Pascagoula River was navigable at low water for boats of 5 feet draft as far up as Cedar Creek, 55 miles, while above this point to the head of the river light-draft navigation was possible on a slight rise above low water.

The Pascagoula River is nontidal, except in its lower reaches.

The report of the examination upon which the improvement was originally based is printed in the Annual Report of the Chief of Engineers for 1879, page 835.

The commerce originating on Pascagoula River above the mouth of Dog River during the calendar year 1908 amounted to 290,327 tons, principally logs, naval stores, and general merchandise, valued at $1,807,500. In addition to this, the combined commerce of Chickasahay and Leaf rivers passed over this stream.

This project has no effect on freight rates.

Available funds and future appropriations will be applied to part payment on snag boat and in continuation of snagging operations.

(*b*) *Leaf River.*—Originally it was impracticable to navigate this river on account of snags, logs, and overhanging trees obstructing the channel. The minimum width of the stream was 100 feet and the minimum depth was 2½ feet at mean low water. The original project

for this improvement was adopted in 1890, its purpose being to afford a channel for high-water navigation from Bowie Creek to the mouth of the river, a distance of 75 miles, by the removal of obstructions and overhanging trees. This project was completed in 1897 at a cost of $11,019.04, since which time expenditures have been in the direction of maintaining the improvement.

No work was done during the fiscal year, the expenditures being applied to part payment for construction of a self-propelling snag boat, now employed on Tombigbee River. With the funds now available and those estimated for 1911, it is proposed to pay part of the cost of a small snag boat to be built for Pascagoula, Leaf, and Chickasahay rivers, and to maintain the improvement.

The total amount expended on this improvement up to June 30, 1909, was $23,146.01, of which $12,126.97 was applied to maintenance.

On June 30, 1909, the river was available for rafting on a fair rise above low water, being used to a very limited extent for any other form of navigation.

For reference to the report upon which this project is based and to descriptions of the improvement, see the Annual Report of the Chief of Engineers for 1904, page 337.

The commerce of Leaf River during the calendar year 1908 amounted to 213,300 tons, principally logs and timber, valued at $636,000.

This project has no effect on freight rates.

(*c*) *Chickasahay River.*—The original condition of this river was such that it was navigable for small rafts only during high water, and even navigation of this character was troublesome and dangerous. The minimum width of the channel was 50 feet and the minimum depth 6 inches at mean low water, the river being badly obstructed by logs and snags.

The original project for the improvement was adopted by the river and harbor act of September 19, 1890, and provided for obtaining a high-water channel from the mouth of the river up to Shubuta, Miss., a distance of 130 miles, by the removal of obstructions from the channel and overhanging trees from the banks. The river and harbor act of June 3, 1896, modified this project by limiting the improvement to that part of the river between the mouth and Bucatunna, Miss., about 75 miles. The project further provided for the maintenance of the improved channel. The project, as modified, was completed in the latter part of 1896, at a cost of $12,399.73.

The existing project was adopted in the river and harbor act of March 3, 1905, and provides for maintaining the channel in Chickasahay River from the mouth to Bucatunna, Miss., by the removal of logs, snags, and other obstructions from the waterway, in order to keep the river in navigable condition for rafting at high-water stages, at an annual cost of $2,500. A reference to the report of the examination upon which this project is based is printed in the Annual Report of the Chief of Engineers for 1905, page 346.

No expenditures were made during the past fiscal year.

With available funds and the amount estimated for 1911 it is proposed to maintain the improvement, including the payment of part cost of a small snag boat suitable for the work on these streams.

The total amount expended on the improvement up to June 30, 1909, was $24,877.46, of which $12,477.73 was applied to maintenance.

This stream is nontidal, and its condition on June 30, 1909, was such that it could be used by flatboats and rafts on a rise of 6 or 8 feet up as far as Shubuta, Miss., though considerably obstructed.

The improvement has had no effect on freight rates.

The commerce of this river during 1908 amounted to 180,125 tons of logs and timber, valued at $923,000.

CONSOLIDATED.

July 1, 1908, balance unexpended	$13,235.56
June 30, 1909, amount expended during fiscal year for maintenance of improvement	7,140.00
July 1, 1909, balance unexpended	6,095.56
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	27,000.00

PEARL RIVER BELOW ROCKPORT, MISS.

The limits of this improvement originally extended from the mouth of the river to Jackson, a distance of 313 miles. By act of Congress of April 21, 1900, the construction of a fixed highway bridge across Pearl River at Rockport was legalized. This point thereby became the head of navigation on the lower river for boats of any considerable size and the upper limit of the project. However, the bridge at Rockport is reported to have been washed away in February, 1906. The distance from Jackson to Rockport is 67 miles.

Prior to improvement the condition of the river was such that it was not navigable except during high-water stages, and even then navigation was difficult and dangerous.

The original project for this improvement was adopted in 1880, and provided for a channel of navigable width and 5 feet deep at low water, by the removal of snags and sunken trees from the river bed and overhanging trees from the banks, at an estimated cost of $95,940. This project having been found to be impracticable, it was modified in 1885 so as to provide for a 2-foot channel at low water throughout this section of the river, at an estimated cost of $145,940.

With past appropriations the river has been improved until it became navigable for light-draft boats on a slight rise up as far as Monticello, about 211 miles above the mouth. Above Monticello the river has never been navigable except on a rise of 7 feet or more.

Appropriations between 1899 and 1907 were applied to the maintenance of the lower 100 miles of river. The project has been about 33 per cent completed.

The work of equipping the snag boat *Pearl* with propelling machinery was completed. During the year the snag boat *Black Warrior* was hauled out and her hull extensively repaired, without which work she could not have lasted another season. During the time when water was low enough for work these two boats removed 2,355 logs, stumps, and snags from the river, besides cutting and pulling back overhanging trees and doing other bank work. The total distance worked over was 188½ miles of river. This work has resulted in opening the channel for navigation by light-draft boats up as far as Columbia, 155 miles above the mouth.

The total amount expended on this improvement to June 30, 1909, was $193,824.29, of which $79,900.55 was applied to maintenance.

The redredging of the 9-foot channel at the mouth of East Pearl River, as recommended in House Document No. 328, Sixtieth Congress, first session, should, it is believed, be considered a separate improvement, and none of the money for Pearl River below Rockport should be applied to it.

It is proposed to apply available funds and future appropriations to the prosecution of snagging work in completion of the project and maintenance of the improvement.

This river is nontidal except in its lower reaches.

The commerce of this part of Pearl River during the calendar year 1908 amounted to 21,744 tons of logs and timber, valued at $239,696.

The project has little effect on freight rates, but when completed it is believed will cause a material reduction in these charges.

July 1, 1908, balance unexpended		$24,201.26
Amount allotted from appropriation by river and harbor act approved March 3, 1909		15,000.00
		39,201.26
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$8,798.74	
For maintenance of improvement	8,815.42	
		17,614.16
July 1, 1909, balance unexpended		21,587.10
July 1, 1909, outstanding liabilities		3,500.00
July 1, 1909, balance available		18,087.10
Amount (estimated) required for completion of existing project		67,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		30,000.00

PEARL RIVER BETWEEN EDINBURG AND JACKSON, MISS.

The original condition of this section of Pearl River was such that navigation was impossible, except during high water, and even at high stages it was difficult and dangerous. The minimum width and depth of the channel was 40 feet and 1 foot, respectively, between Carthage and Jackson, while above Carthage the channel had a minimum width of 30 feet and a minimum depth of 3 inches, at mean low water. This improvement was formerly divided into two sections, for which appropriations were made separately. The original project for the section from Jackson up to Carthage, 101 miles, as adopted in 1879, contemplated obtaining a clear channel of navigable width and 5 feet depth at low water, at an estimated cost of $21,000. In 1886 this project was modified so as to provide for a channel 2 feet deep, this depth being considered sufficient for the needs of navigation, and at the same time the estimate of cost was increased to $50,000. Work under this project was completed in 1893, at a total cost of $26,014.98, since which time funds have been applied to maintenance.

The original project for the part of the river from Carthage up to Edinburg, a distance of 25 miles, was adopted in 1884 and provided for the formation of a high-water channel for use during six or eight

months of the year, at an estimated cost of $13,464, and for the maintenance of same at an annual cost of $500. The work of improvement under this project was completed in 1890 at a cost of $5,857.08, subsequent appropriations being applied to the work of maintenance.

The river and harbor act approved June 13, 1902, made one appropriation for this section, since which it has been considered as a single improvement and appropriations made accordingly.

During the past fiscal year snagging operations were carried on in this section of Pearl River from July 17 to December 10, 1908, when high water interrupted, and from June 1 to 30, 1909. During this time 40 miles of the river were worked over, an in addition to the bank work, such as cutting some overhanging trees, pulling back others, trimming bushes, and leveling stumps, there were removed from the river channel 1,845 logs, snags, and stumps. The improvement has been maintained and is available for light-draft navigation during high-water season. For efficient work a small nonpropelling snag boat is needed here, and the cost of such a boat has been included in amount estimated as needed for this improvement.

Up to June 30, 1909, the total amount expended on this improvement was $65,986.53, of which about $34,114.47 had been applied to maintenance.

During the calendar year 1908 the commerce on this section of Pearl River was 418 tons of general merchandise, valued at $18,000.

The improvement has had no effect on freight rates.

July 1, 1908, balance unexpended	$2,449.69
Amount allotted from appropriation by river and harbor act approved March 3, 1909	3,000.00
	5,449.69
June 30, 1909, amount expended during fiscal year for maintenance of improvement	2,136.22
July 1, 1909, balance unexpended	3,313.47
July 1, 1909, outstanding liabilities	450.00
July 1, 1909, balance available	2,863.47
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	5,000.00

WOLF AND JORDAN RIVERS, MISSISSIPPI.

The least depth on the bar at the mouth of Wolf River is something under 3 feet, and on the bar at the mouth of the Jordan River it is not quite 4 feet.

The present and only project was adopted by the river and harbor act of March 2, 1907, and provides for the formation of a channel 7 feet deep and 100 feet wide at bottom, with side slopes of 1 on 6, across the bar at the mouth of each of the streams named, from the 7-foot curve of depth in the river to the 6-foot contour in Bay St. Louis, at a cost of $30,000 for completing the work and $5,000 per annum thereafter for maintenance. After reaching the 6-foot contour in the bay the material becomes so soft that a draft of 7 feet can easily be carried through it.

During the fiscal year ending June 30, 1908, a channel 8 feet deep and 100 feet wide was dredged from the 6.7-foot curve through the bar to the 5.3-foot curve at the mouth of Wolf River, and at the mouth of Jordan River from the 6.7-foot curve through the bar to the 5.5-foot curve, completing about 95 per cent of the project.

During the past fiscal year no work was done here, but there was an expenditure of $500 as part payment for the new U. S. S. *Chickasaw*.

The channels have maintained themselves very well. Some shoaling has taken place in Wolf River, but as the shoals do not run entirely across the channel dredged the available depth remains about the same.

A mean low-water draft of 7 feet can be carried through either channel and the average range of the tide is 1¾ feet.

Additional appropriations, when made, will be applied to maintenance.

The report of the examination and survey upon which the project is based is printed in House Document No. 917, Fifty-ninth Congress, first session.

The commerce on these rivers during the calendar year 1907 amounted to 55,387 tons of lumber, rosin, turpentine, and general merchandise, valued at $931,412.

The improvement has been of immediate and considerable local benefit. The work is too recent to determine its effect on freight rates, but it is believed to have little, if any, such effect.

The total amount expended on this improvement up to the close of the past fiscal year was $29,195.19, none of which was applied to maintenance.

July 1, 1908, balance unexpended	$1,304.81
June 30, 1909, amount expended during fiscal year, for works of improvement	500.00
July 1, 1909, balance unexpended	804.81
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

MOUTH OF YAZOO RIVER AND HARBOR AT VICKSBURG, MISS.

The shifting bar at the former mouth of the Yazoo was the most serious obstruction to navigation of that river and its tributaries, a system comprising about 800 miles of navigable waterways. At low stages steamboats were prevented from entering or leaving the river without lightering their cargoes across the bar, and it frequently happened that the outlet was entirely closed to navigation throughout the busiest season of the year.

Prior to 1876 the city of Vicksburg possessed the most commanding site and the finest harbor on the Mississippi River. There was deep water along the city front, and the entire width of the river was available for steamboats at all stages, with not less than 25 feet depth in any part of the harbor. The cut-off of April 27, 1876, and subsequent shoaling of the old channel from the river to the front of the city, practically destroyed the harbor, which became unnavigable except at high stages.

The original project for improving Vicksburg Harbor was entered upon under the river and harbor act of June 18, 1878. The first work consisted of revetting the rapidly caving bank at Delta Point, La.,

opposite Vicksburg, the continued recession of which was increasing the distance from the harbor to the river channel. The river and harbor act of August 2, 1882, placed the work under the Mississippi River Commision, and the revetment at Delta Point was continued until 1900. No work has been done since. Some caving has occurred above the upper end of the revetment, which is protected by a hard point, but there appears to be no immediate danger of flanking. The amount expended at Delta Point was $389,486.08.

When Vicksburg Harbor was placed under the Mississippi River Commission in 1882, a project was adopted for dredging a basin 1,700 feet long by 300 feet wide in front of the city, with a canal 150 feet wide to connect it with the river. Dredging under this project amounted to 250,035 cubic yards in 1883, when discontinued. It was resumed in 1888, under a slightly modified project, and continued until 1893. During the latter period the dredging amounted to 1,729,994 cubic yards, making a total of 2,080,029 cubic yards of excavation. In 1888 pile dikes were built at the north end of the basin and along the west side of the canal, aggregating 6,800 feet in length. The expenditures for Vicksburg Harbor were $442,724.77, which, added to the amount expended at Delta Point, makes a total of $832,210.85. The improvement of Vicksburg Harbor was transferred to the Engineer Department under a provision of the river and harbor act of August 18, 1894.

The existing project adopted by Congress in the river and harbor act of July 13, 1892, contemplated opening a new mouth or outlet for Yazoo River from its original mouth on Old River (9.8 miles above the former outlet to the Mississippi) through deep water down the wrong end of Old River, thence across a neck of low land between Old River and Lake Centennial and around the head of De Soto Island and down the east arm of Lake Centennial to the Mississippi River, entering it upon the channel side at Kleinston Landing.

Lake Centennial is the old bend of the Mississippi River cut-off in 1876, and De Soto Island, prior to the cut-off, was the Louisiana peninsula, around which the river flowed. The estimate of cost—$1,500,000—was revised in 1893 and reduced to $1,200,000.

The work was completed in 1905 at a cost of $1,179,210.87. Subsequent expenditures for maintenance amount to $34,788.58. The new outlet was opened in the spring of 1903; uninterrupted navigation of Vicksburg Harbor has been maintained for six years, and the new mouth of Yazoo River has been open to boats of 6 feet draft at mean low water. The extreme range between high and low water at Vicksburg is 59 feet, but the usual variation is about 45.3 feet.

The chief features of this work were the purchase of 1,155.54 acres of land for right of way of the main cut from Old River to Lake Centennial; the clearing and grubbing of the entire route; the excavation by dredging of 6,229,281 cubic yards of earth in opening the new outlet, of which about 934,000 cubic yards was used for building a dam, above ordinary low water, across the west arm of Lake Centennial from mouth of the main cut to head of De Soto Island, and constructing a levee containing 429,677 cubic yards from mouth of the canal at Kleinston westward along West Pass bar (which separates the west arm of Lake Centennial from Mississippi River) to within about 4,500 feet of King Point.

The work performed during the fiscal year ending June 30, 1909, was for maintenance, principally for repairs and protection of the West Pass levee. Expenditures of $40,000 for revetment of West Pass levee on the lake side, to protect it from wave wash, and to replace decaying wooden bulkheads, and $4,000 for surveys, were authorized and allotments for the purposes were made under section 1 of the river and harbor act of March 3, 1909. The revetment was partially built in April and May, 1909, 1,194 squares having been paved. It will be completed during the fiscal year 1910, and the surveys will be made during the period of low water.

The annual commerce of Yazoo River, its tributaries, and Vicksburg Harbor, as reported for seven years, varied between 222,792 and 441,765 tons, the estimated values of which ranged from $6,801,000 to $13,272,000 per annum. The average of the commerce was 321,594 tons per annum, and the average value $8,753,650.

The estimated amount that can be profitably expended in the fiscal year ending June 30, 1911, will be applied to maintenance by dredging in Old River.

July 1, 1908, balance unexpended	$7,844.71
Amount allotted from appropriation by river and harbor act approved March 3, 1909	44,000.00
	51,844.71
June 30, 1909, amount expended during fiscal year for maintenance of improvement	21,844.16
July 1, 1909, balance unexpended	30,000.55
July 1, 1909, outstanding liabilities	402.31
July 1, 1909, balance available	29,598.24
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	8,000.00

YAZOO, TALLAHATCHIE, COLDWATER, AND BIG SUNFLOWER RIVERS, AND TCHULA LAKE, MISSISSIPPI.

These improvements were consolidated by river and harbor act of June 13, 1902. The same kind of work is required in all, i. e., the removal of wrecks, snags, stumps, tree slides, sunken logs, leaning timber, etc., for maintenance of navigation.

(*a*) *Yazoo River.*—Before improvement the period of navigation was limited to high stages on which steamboats could pass the wrecks of gunboats, steamers, and raft sunk during the civil war. The channel was much obstructed also by snags, stumps, tree slides, leaning timber, etc.

The project entered upon March 3, 1873, contemplated removing obstructions to give ease and safety to navigation. Subsequent acts of Congress provided for continuing the improvement and for maintenance. There is no practical distinction between improvement and maintenance, as floods, sliding and caving banks, and the rapid growth of vegetation along alluvial streams of this kind constantly add obstructions and render a continuance of snagging operations necessary in the interest of safe and uninterrupted navigation.

The total expenditure to June 30, 1909 (including $203.26 derived from sales), was $404,508.94, which has resulted in safe and uninter-

rupted navigation from mouth to head of the river the year round for more than twenty-five years. Steamboats of 3½ feet draft navigate the river at mean low water without serious difficulty.

During the fiscal year ending June 30, 1909, snagging operations, etc., for maintenance, extended over the entire river.

The range between high and low water at Yazoo City is 40.8 feet. It is proposed to apply the available funds to continuing work for maintenance of the improvement.

The estimated amount that can be profitably expended in the fiscal year ending June 30, 1911, in addition to the balance unexpended July 1, 1909, will be applied to removal of obstructions, including snags, overhanging trees, drift, etc., and the maintenance and operation of snag and dredge boats. This additional work is for maintenance and extension of benefits.

(*b*) *Tallahatchie and Coldwater rivers.*—Before improvement Tallahatchie River was navigable to Sharkey, about 65 miles above its mouth, for six months of the year, but passage was difficult and dangerous on account of the number of obstructions in the channel and along the banks, and the wreck of the ocean steamship *Star of the West*, sunk February, 1863, 8 miles above the mouth. Above Sharkey the growth of leaning timber was so dense and the channel so obstructed by snags, etc., that that part of the stream practically was unnavigable. The same conditions continued up the Coldwater River.

The project entered upon March 3, 1879, contemplated removing obstructions in Tallahatchie River from the head of Yazoo River to the mouth of Coldwater River and up the Coldwater about 80 miles to Yazoo Pass. Work in the Coldwater River was abandoned in 1881, but was resumed under a provision of the river and harbor act of March 3, 1905.

The amount expended to June 30, 1909 (including $40 derived from sales), was $84,031.36, and the work performed permits steamboats of 3 feet draft to run to Sharkey the year round and into Coldwater River at moderately high stages.

Marks, on Coldwater River, is considered the present head of navigation, and boats rarely run above that place.

During the fiscal year ending June 30, 1909, work for the removal of obstructions in Tallahatchie River was continued between Minter City and Yazoo River, 68½ miles, benefiting navigation materially.

Work in Coldwater River extended from its mouth upstream to Yazoo Pass, but was not thorough on account of interruptions and unfavorable conditions caused by high stages.

Operations for maintenance will be continued with the available funds.

The estimated amount that can be profitably expended during the fiscal year ending June 30, 1911, in addition to the balance unexpended July 1, 1909, will be applied to the removal of obstructions, including snags, overhanging trees, drift, etc., and the maintenance and operation of snag and dredge boats. This additional work is for maintenance and extension of benefits.

(*c*) *Tallahatchie River above mouth of Coldwater River to Batesville.*—To comply with requirements of river and harbor acts of 1880, 1881, and 1882, a total expenditure of $10,000 was made to clear this stretch of obstructing trees, stumps, and snags, after which work was

discontinued by the United States. Commerce was revived in 1904, and, after the worst obstructions had been removed by popular subscription, about 2,100 tons of stave and spoke billets and other freight, valued at $100,000, was transported by steamboat.

The project entered upon March 2, 1907, contemplated an expenditure of $2,000 a year for a series of years to put the river in such condition that boats plying the lower Tallahatchie can safely run to Batesville for five to seven months of the year, eventually the cost of maintenance to be reduced to $1,000 per year.

The total amount expended to June 30, 1909, was $13,824.89. The work was resumed in May, 1907, after a lapse of twenty-five years, and was continued downstream to the mouth of Coldwater River. The chief obstructions to navigation were removed and the stretch placed in fairly good navigable condition. The cost of this maintenance was $3,824.89; and the work proved heavier and more difficult than was anticipated.

No work was performed during the fiscal year 1909 for lack of funds during the period of low water.

The recent allotment and the estimated amount that can be profitably expended during the fiscal year ending June 30, 1911, will be applied to the removal of obstructions, including snags, overhanging trees, drift, etc., and the maintenance and operation of snag and dredge boats. This additional work is for maintenance and extension of benefits.

(*d*) *Big Sunflower River.*—Before improvement this stream was navigable about six months of the year, but was obstructed by snags, sunken logs, sand bars, and shoals; navigation was impeded by leaning timber, and at many places the channel was so choked with obstructions and so narrow that it afforded passage for the smallest craft only.

The project entered upon March 3, 1879, contemplated the removal of obstructions between the mouth and Clarksdale, about 180 miles, and the building of inexpensive pile and brush wing dams to scour depths of about 40 inches at the bars. Prior to the building of the Mississippi River levees, and since, when crevasses in the levees occurred, this stream carried large quantities of overflow water and its section was increased thereby. In this enlarged bed the normal river at low stages now flows between secondary banks and, as a rule, the main banks are not overtopped by floods, except near the mouth, where the flood height is affected by backwater from the Mississippi.

On account of the changed conditions, the river and harbor act of March 2, 1907, placed the upper limit of improvement at the mouth of Hushpuckena River, about 30 miles below Clarksdale; authorized a continuation of the work of removing obstructions below that point, and an improvement of the lower section, below Baird, about 87 miles, with a view to obtaining a navigable depth of 3 feet by means of the closure of outlets and more extensive contraction works. The estimates of cost for work below Baird ware $75,000 for the necessary closing dams, about $10,000 per year for five years for continuation of the open-river work, and $5,000 per year thereafter.

The amount expended to June 30, 1909, was $166,375.20. The cutting of leaning timber, removal of channel obstructions, and the building and renewal of wing dams at the bars maintained naviga-

tion in the lower 100 miles of river, and enabled boats of 30 inches draft to run to Woodburn, about 77 miles above the mouth, at mean low water. Faisonia, about 100 miles above the mouth, is considered the head of navigation. A contract was entered into November 12, 1907, for closing the chutes in lower Big Sunflower River, requiring 118,755 cubic yards of levee embankment, and the work has now been completed.

During the fiscal year ending June 30, 1909, operations for maintenance continued during the period of low water, between the mouth of Big Sunflower River and a point 4 miles above Baird, and consisted of the removal of snags, leaning timber, etc., obstructing navigation and the construction and repair of wing dams at shoal places.

The contract for closing the chutes in lower Big Sunflower River was completed February 20, 1909.

It is proposed to apply the available funds and the additional appropriation recommended to a continuance of snagging operations and the building and repair of wing dams where required.

(*e*) *Tchula Lake.*—This is an arm of Yazoo River, about 60 miles long, and east of Honey Island, in Holmes County. Before improvement it was obstructed its entire length by a net work of snags, heavy leaning timber, and a thick growth of brush along both banks.

The project adopted March 3, 1881, contemplated removal of the obstructions to prolong the navigable period and to permit light-draft steamboats to pass through the lake earlier in the cotton season.

The amount expended to June 30, 1909, was $31,962.09. The work was practically completed and the stream put in safe navigable condition in 1895 at an expenditure of $21,000. Since 1902 $10,962.09 has been expended for maintenance.

During the fiscal year ending June 30, 1909, work for maintenance extended from the head of the lake downstream about 35 miles to near Black Bayou, and consisted of the removal of snags, leaning trees, etc., obstructing navigation.

The available funds will be applied to continuing work for maintenance.

The estimated amount that can be profitably expended during the fiscal year ending June 30, 1911, in addition to the balance unexpended July 1, 1909, will be applied to the removal of obstructions, including snags, overhanging trees, drift, etc., and the maintenance and operation of snag and dredge boats. This additional work is for maintenance and extension of benefits.

The chief shipments of Yazoo River and tributaries are cotton, cotton seed, staves, timber, etc., with return freights of general merchandise and plantation supplies. The commerce of eighteen years ranges between 102,098 and 544,503 tons annually, with values estimated at $2,840,000 to $9,198,000, the average being 241,573 tons, valued at $5,590,330.

Freight rates on cotton by boat are about 50 per cent less than by rail; on cotton seed about 33⅓ per cent less. Live-stock shipments by boat cost about one-third of the railroad rates, and grain, flour, meal, and provisions shipped by boat cost about 50 per cent less than by rail. To inland points the railroad rates are largely in excess of boat rates for the same distance. Large quantities of timber are rafted, which could not be reached by rail.

Reports of examinations of Tallahatchie River above mouth of Coldwater to Batesville, and of Big Sunflower River, made in 1905, were printed in House Documents Nos. 147 and 667, Fifty-ninth Congress, first session. Reports of an examination and survey of Big Sunflower River from near Baird to mouth of Hushpuckena River, made in 1907 and 1908, were printed in House Document No. 1251, Sixtieth Congress, second session.

CONSOLIDATED.

July 1, 1908, balance unexpended		$157,415.51
Amount allotted from appropriation by river and harbor act approved March 3, 1909		30,000.00
Amount received from sales of property		132.80
		187,548.31
June 30, 1909, amount expended during fiscal year:		
For constructing snag boat	$12,363.17	
For maintenance of improvement	77,146.36	
		89,507.53
July 1, 1909, balance unexpended		98,040.78
July 1, 1909, outstanding liabilities		3,603.04
July 1, 1909, balance available		94,436.84
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		57,000.00

STEELE AND WASHINGTON BAYOUS, ETC., MISSISSIPPI.

Following are extracts from report on recent examination and survey printed in House Document 904, Sixtieth Congress, first session:

These bayous drain an alluvial area between the Mississippi River and Deer Creek about 5 to 12 miles wide and 40 miles long, of which about one-half to two-thirds is now overflowed from backwater annually.

The channel of Steele Bayou is described on page 1361 of the Annual Report of the Chief of Engineers for 1884, but since that time some improvement has taken place due to work of removing leaning trees, logs, snags, and stumps. The bayous are still greatly obstructed, however, by these obstacles.

The bayous are of ample width for navigation and the relative elevations of Lake Washington and the water surface of the Mississippi River at Vicksburg at high stages indicate that the water is backed up into Steele Bayou sufficient to give enough depth for large boats during several months of the year.

The clearing of the land along Steele Bayou has extended from a point about 25 miles above its mouth for a distance of about 25 miles upstream, measured in a straight line, and over a width of about 2 miles.

It is estimated that the outgoing commerce from this district is that due principally to 20,000 to 30,000 bales of cotton per year, to the product of the oil mill at Glen Allan, and the two sawmills on Steele Bayou. The return commerce is also considerable. This commerce will probably increase as the clearing of the land progresses.

It appears that no large boats have navigated the bayous since the high water of 1897, when they became choked with logs and trees, but the description of commercial conditions presented by the district officer indicates the probality of these waterways being used in the future for commercial purposes if opened up to navigation.

The Chief of Engineers in submitting the report says:

Portions of these waterways were improved by the United States between 1884 and 1892 by the removal of snags, logs, leaning trees, and other obstructions, and a similar improvement is now proposed at an estimated cost of $15,000 extending over a period of about five years.

I concur in the opinion of the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors that this locality is worthy of improvement by the General Government to the extent indicated.

BEAR CREEK, MISSISSIPPI.

The following are extracts from House Document No. 908, Sixtieth Congress, first session, relating to a recent survey. In his report on a preliminary examination, dated October 10, 1907, the local engineer says:

Bear Creek has a total length of about 90 miles, rising in Mosquito Lake, flowing through the counties of Leflore, Sunflower, and Washington, and emptying into Yazoo River about 6 miles above the town of Belzona. Its navigable portion of about 25 miles is through a succession of four lakes at the lower end, viz, Threemile Lake, Sixmile Lake, Fourmile Lake, and Wasp Lake. These lakes are from 200 to 600 feet wide, from 3 to 8 miles long, and from 2 to 20 feet deep at low water. They are joined by connecting water courses, which are practically dry at low water and which require a stage of 15 feet in Yazoo River to enable the small boats used to run. Such a stage obtains, on an average, three months per year, the minimum in the last twenty years being 3 days in a year and the maximum 174 days in a year. Even at high stages boats experience difficulty in running, as the connecting water courses are grown up with bushes and trees, through which the boats must push.

The lands along the creek are well developed; about 5,300 bales of cotton are produced annually, valued, with the seed, at nearly half a million dollars. In addition there are four sawmills on the creek, cutting 7,000,000 or 8,000,000 feet per annum, and one shingle mill, and one mill making wagon-wheel rims. With the exception of the latter, the mills are from 2 to 6 miles from the railroad.

Two branch railroads parallel the general course of the creek, that on the west belonging to the Yazoo and Mississippi Valley Railroad and that on the east to the Southern Railway. The haul from plantations along the creek to the nearest railroad averages about 4 miles, over roads which are extremely bad in the early winter and spring, just when the creek is most likely to be navigable.

Three small steamboats made several trips up Bear Creek last season, but no record could be obtained of all the freight carried. One planter reports 51 bales of cotton, 35 tons of cotton seed, and $1,500 worth of merchandise shipped last year by boat.

The Chief of Engineers, in transmitting the report, says:

The improvement proposed consists in the removal of undergrowth and other obstructions to the use of the navigable portion of the creek at times of high water. The cost of the work is estimated at $3,000, with an expenditure of about $2,500 for a repetition of the work at the end of three years.

I concur in the opinion of the district officer, the present division engineer, and the Board of Engineers for Rivers and Harbors that this locality is worthy of improvement to the extent indicated, leaving the question of further maintenance to be decided after the work now proposed has been accomplished and its effect upon the commerce of the locality has been noted.

BAYOU BARTHOLOMEW, BOEUF RIVER, TENSAS RIVER, AND BAYOU MAÇON, AND BAYOUS D'ARBONNE AND CORNEY, LOUISIANA AND ARKANSAS.

These streams are tributaries of Ouachita River and are not navigable at low stages. The works were consolidated by the river and harbor act of June 13, 1902. The improvements are all of the same character, i. e., the removal of snags, wrecks, leaning timber, etc., to lessen the danger and lengthen the period of navigation. Drift, sliding and caving banks, and the rapid growth of vegetation constantly add obstructions.

(*a*) *Bayou Bartholomew, Louisiana and Arkansas.*—Before improvement this stream was navigable for light boats about three

months of the year. In 1880 an examination showed that passage-way for steamboats was much obstructed.

The project adopted March 3, 1881, contemplated removing obstructions between the mouth and Baxter, Ark., 182 miles.

The amount expended to June 30, 1909, was $66,866.97. The project practically was completed in 1897 to McComb Landing, Ark., the present head of navigation, 141 miles, at a cost of $45,873.53. This work resulted in safer navigation, increased the period to about six months of the year, enabled boats to make trips in half the time formerly required, and reduced freight rates about 50 per cent. There being no demand for navigation above McComb Landing, subsequent expenditures were for maintenance, and $20,993.44 has been applied to that purpose.

Operations for maintenance during the fiscal year ending June 30, 1909, extended from the mouth to Point Pleasant, La., 28.7 miles, and put that part of the stream in fair navigable condition.

The commerce consists of shipments of cotton, cotton seed, staves, saw logs, etc., with return freights of general merchandise and plantation supplies. Much of the trade has been diverted to railroads, as the stages of the bayou frequently are not coincident with the needs of transportation. The commerce for nineteen years ranges between a maximum of 49,299 tons in 1891 and a minimum of 1,502 tons in 1907, the average being 12,000 tons, valued at $307,640.

The available funds and the estimated amount that can be profitably expended in the fiscal year ending June 30, 1911, will be applied to removal of snags, overhanging trees, drift, etc., for maintenance.

(*b*) *Boeuf River, Louisiana.*—Before improvement this river was navigable to Point Jefferson, 151 miles, but passage was difficult and dangerous on account of overhanging timber and snags and logs in the channel.

The project adopted March 3, 1881, contemplated removing these obstructions to afford safe navigation at high stages to Wallace Landing, La., about 170 miles above the mouth. Under the river and harbor act of 1886 a supplemental project was entered upon for the closure of three outlets near Point Jefferson to confine the flow to the main channel.

The total expenditure to June 30, 1909, was $68,243.53. The original project was completed in 1896 at a cost of $40,992.84. Since then $21,808.91 (including $27.75 received from sales) has been expended for maintenance. In 1887–88, by uniting with planters whose lands would be protected from overflow, the outlets near Point Jefferson were closed by earthen dams, the proportion of the cost borne by the United States having been $5,441.78.

The work put the stream in safe navigable condition at stages high enough to permit steamboats to cross the bars and, when completed, enabled them to save thirty-six hours' time on a trip.

The closure of the outlets gave immediate benefit to navigation by concentrating the flow to the main stream, lengthening the period of navigation, and causing the bars to scour. The dams, however, were destroyed in 1890, during an overflow from Mississippi River, caused by crevasses in the levees near the headwaters of Boeuf River, and funds for their restoration have not been provided.

During the fiscal year ending June 30, 1909, snagging work and the removal of leaning trees, etc., extended from the mouth upstream to

Point Jefferson, La., 150.8 miles, and the chief obstructions of this character were destroyed for the time.

The commerce consists of shipments of cotton, cotton seed, staves, etc., and return freights of general merchandise and plantation supplies, and for nineteen years ranges between a maximum of 11,261 tons in 1897 and a minimum of 545 tons in 1903, the average being 5,459 tons, valued at $232,400.

The available funds and the additional amount estimated for the fiscal year 1911 will be applied to maintenance by the removal of obstructions, including snags, overhanging trees, drift, etc. This additional work is for extension of benefits.

Navigation is rendered more difficult on account of the outlets at Point Jefferson, and additional interest in the project for again closing them is maintained through the necessity of draining Bayou Lafourche Basin, into which the outlets flow, to permit development of a rich tract of land containing 220,800 acres, much of which has been converted into a swamp and all of which is seriously affected by flood water from Boeuf River.

(*c*) *Tensas River and Bayou Maçon.*—Before improvement these streams were navigable at high stages, but the passage of steamboats was difficult and dangerous on account of leaning timber and numerous snags, logs, stumps, etc., in the channel.

The project adopted March 3, 1881, contemplated removing obstructions in Tensas River from its mouth to Dallas, La., 138 miles. Bayou Maçon, the chief commercial branch of Tensas River, was added under the same head of appropriation by river and harbor act of 1884, and the project contemplated the same kind of work from its mouth to Floyd, La., 112 miles.

The total expenditures to June 30, 1909, were $58,527.75. The project for Tensas River was completed in 1898 to Westwood Place, 81 miles above the mouth, the present head of navigation, at a cost of $11,947.02, and the project for Bayou Maçon to Floyd was completed in 1899 at a cost of $23,915.42. Lane Ferry, about 20 miles above Floyd, is the head of navigation in Bayou Maçon. The sum of $22,665.31, including $27.75 derived from sales, has been expended for maintenance. The work put the two streams in fairly good navigable condition at medium and high stages. Upper Tensas River above Westwood Place practically is unnavigable by reason of leaning timber and obstructions in the channel, and there has been no recent effort to induce a resettlement of the abandoned plantations along its banks or to secure a continuance of the improvement to Dallas.

During the fiscal year ending June 30, 1909, work for maintenance was continued and consisted of the removal of snags, leaning trees, etc., obstructing navigation of Tensas River between Westwood Place and its mouth. No work was performed in Bayou Maçon.

The commerce consists chiefly of shipments of cotton, cotton seed, staves, etc., and return freights of plantation supplies. In nineteen years it has ranged between a maximum of 29,957 tons in 1905 and a minimum of 2,649 tons in 1893, the average being 15,187 tons, valued at $612,340.

It is proposed to apply the available funds to maintenance, and the additional estimate for the fiscal year 1911 to the removal of obstruc-

tions, including snags, overhanging trees, drift, etc. This additional work is for maintenance and extension of benefits.

(*d*) *Bayous D'Arbonne and Corney, Louisiana.*—Before improvement navigation of these streams was difficult and dangerous on account of the leaning trees and the number of snags, stumps, etc., in the channel.

The project adopted July 5, 1884, contemplated removing the obstructions between the mouth of Bayou D'Arbonne and Stein Bluff on Bayou Corney, 40½ miles upstream. The river and harbor act of 1892 authorized an extension of work up Bayou Corney 16½ miles to Cobb Landing, and the act of 1894 provided $1,000 for removing obstructions in the Little D'Arbonne Branch.

The amount expended to June 30, 1909, was $23,974.95, and resulted in greater safety to navigation. The work practically was completed in 1896 at a cost of $18,000. Subsequent expenditures for maintenance have amounted to $4,974.95, and $1,000 was expended for improving Little D'Arbonne Branch.

No work was done during the fiscal year ending June 30, 1909, as the stages were not favorable since the allotment was made for its continuance.

The commerce consists of shipments of cotton, cotton seed, etc., and return freights of plantation supplies. It varies considerably, and during thirteen years ranged between a maximum of 36,272 tons in 1907 and a minimum of 682 tons in 1903, the average being 11,369 tons, valued at $317,420.

The estimated amount that can be profitably expended in the fiscal year ending June 30, 1911, and the balance unexpended July 1, 1909, will be applied to removal of obstructions, including snags, overhanging trees, drift, etc. This additional work is for maintenance and extension of benefits.

There is no record of freight rates on Bayou Bartholomew and works consolidated with it available for making a comparison of the effect of the improvement. In a general way it may be stated that the rates have been greatly reduced; in fact, the traffic is no longer sufficiently lucrative to support the class of boats formerly plying on this stream, but it is now carried by smaller boats. This is largely due, however, to the competition by the railroads, and now boats ply only where the river is the only shipping route.

CONSOLIDATED.

July 1, 1908, balance unexpended	$11,577.12
Amount allotted from appropriation by river and harbor act approved March 3, 1909	15,000.00
Amount received from sales of property	55.50
	26,632.62
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	9,190.32
July 1, 1909, balance unexpended	17,442.30
July 1, 1909, outstanding liabilities	145.90
July 1, 1909, balance available	17,296.40
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	16,000.00

MOUTH AND PASSES OF CALCASIEU RIVER, LOUISIANA.

Prior to improvement there existed a depth of 6½ feet over the outer bar at the entrance to Calcasieu Lake. The lake was 15 miles in length, with a depth of 6 feet. The depth of water over the inner bars was 3½ feet, and from the upper bar to Lake Charles, La., the river was not less than 8 feet deep.

Under the original project of 1872, with the modification of 1881, a channel 8 feet in depth, 70 feet wide, and 7,500 feet in length was cut through the inner bars during 1874, 1882, and 1883; but this channel having shoaled to 3½ feet, it was redredged in 1886, under the project of that year, and a plank revetment to provide against refilling was commenced. The noncompletion of this revetment caused the refilling of the channel. There was expended on this project $54,158.86.

The project adopted by the act of September 19, 1890, provides for the redredging of a channel 8 feet in depth through the inner bars and revetting this channel, to construct parallel jetties of brush and stone at the entrance to the outer pass, and to dredge a channel between these jetties to a depth of 12 feet, if necessary. The total estimated cost of the jetties was $600,000.

Under this project the revetment was completed in August, 1893. A channel 8 feet deep and 50 feet wide, connecting deep water in Calcasieu Pass and Lake, was dredged in 1894, 1895, and 1898. Construction of the east jetty was carried on in 1894, 1895, and 1896, and of the west jetty in 1897. In 1900 the foundation of the west jetty was extended 1,000 feet, making its total length 3,200 feet.

By May, 1905, the channel, dredged to a depth of 8 feet in 1903 through the inner pass, had shoaled to less than 4 feet, and the revetment placed for protection of this channel had almost entirely disappeared.

The channel through the outer pass between the jetties had a depth at low tide of about 10 feet, which is ample for the present needs of navigation, considering the condition of channel through the inner pass.

Under the project for expenditure of amount appropriated by act of March 3, 1905, a survey was made from the mouth of the river to the outer pass; the channel at the inner pass was redredged to a depth of 7 feet and width of 100 feet for a length of 24,000 feet; the channel at the mouth of the river was redredged to a depth of 7 feet and width of 100 feet for a length of 10,000 feet; the entire channel through the lake was marked by creosoted pile clusters, 54 in number, at intervals of 1,500 feet; and the revetment at lower end of lake (inner pass) was rebuilt for a length of 8,230 feet. Dredging and marking channel were completed, under contract, August 25, 1906, and repairs to revetment April 6, 1907.

Project for maintenance of the improvement was adopted in act of March 2, 1907.

It is proposed to apply available funds toward the construction of a combined dredge and snag boat and to the operation of the dredge for the maintenance of the authorized depths in the channels at the mouth and passes of the river. On June 30, 1909, this boat was three-fourths completed.

The amount expended to June 30, 1909, is $636,477.99. Of this amount $582,319.13 has been expended under the present project, of which it is estimated that $120,577.81 was applied to maintenance; $0.45 was derived from refundment of overpayment, and $2.50 from sales of blueprints. The expenditures during the past fiscal year were for collection of commercial statistics, construction and inspection of boat.

The improved project provides for a channel depth of 8 feet through the bars at the head and foot of the lake, but the maximum depth in the lake is only about 7 feet. On June 30, 1909, the maximum draft that could be carried at mean low water through the shoalest part of the channel in Lake Calcasieu was 6 feet, and the usual variation of the water surface is about 1 foot.

The head of navigation in the Calcasieu River is at Jones Bluff, about 58 miles above its mouth, or 28 miles above Lake Charles, La., the depth in the channel being not less than 12 feet. The river empties into Calcasieu Lake, the length of the navigable channel through which is about 17 miles. Calcasieu Pass is about 6 miles long and connects Calcasieu Lake with the Gulf of Mexico, the least depth in the channel being about 10 feet.

The only information obtained as to the effect of the project on freight rates is statements from the secretary of the state railroad commission and from the general freight agent of the Southern Pacific Railroad, that Lake Charles and other points on this river enjoy benefits in the way of reduced freight rates, due to the fact that they are situated on navigable water.

The amount estimated for expenditure in the fiscal year ending June 30, 1911, is intended for maintaining the authorized depths by dredging and necessary repairs to accessory structures.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31, 1899	174,651	.....	15,366
Calendar year—			
1900	139,580	.....	.....
1901	139,045	.....	535
1902	148,483	9,438	.....
1903	194,155	45,672	.....
1904	226,216	32,061	.....
1905	295,067	68,851	.....
1906	314,235	19,168	.....
1907	355,795	41,560	.....
1908	360,252	4,457	.....

July 1, 1908, balance unexpended	$24,928.78
Amount allotted from appropriation by river and harbor act approved March 3, 1909	8,000.00
	32,928.78
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	4,903.82
July 1, 1909, balance unexpended	28,024.96
July 1, 1909, outstanding liabilities	486.93

July 1, 1909, balance available	$27,538.03
July 1, 1909, amount covered by uncompleted contracts	3,413.34
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	8,000.00

BOGUE FALIA, CHEFUNCTE RIVER, TICKFAW RIVER AND TRIBUTARIES, AMITE RIVER, AND BAYOU MANCHAC, LOUISIANA.

(*a*) *Bogue Falia and Chefuncte River.*—Prior to improvement of Chefuncte River, a bar, with a depth of only 4½ feet of water, obstructed the entrance to the mouth of the river. From this point to its junction with the Bogue Falia, a distance of 10 miles, the river was from 300 to 800 feet in width, with a channel of 15 feet in depth, navigable for steamers and sailing vessels, but obstructed by snags and overhanging trees. Above this point the stream is not navigable.

Bogue Falia was navigable for small steamers from point of junction with the Chefuncte to Grants Landing, 4 miles above; for sailing vessels drawing 5 feet or less, to Covington, 2 miles farther; obstructed by snags and overhanging trees. Not navigable beyond Covington.

The original project of 1880 provided for dredging through the bar at the mouth of the Chefuncte River, and for the removal of all obstructions between its mouth and Covington on the Bogue Falia, at an estimated cost of $5,460. It was modified in 1884 to permit of the construction of a breakwater to protect the channel dredged across the bar at the mouth of the Chefuncte River. Estimated cost, $1,500.

For an account of the improvements under original project and modification, see Annual Report of the Chief of Engineers for 1896, page 1485. Subsequent operations have been for maintenance.

It is proposed to apply the available funds toward the construction of a combined dredge and snag boat and to the operation of said boat for the removal of bars and such snags, logs, and overhanging trees as interfere with navigation between Covington and the mouth of the river. On June 30, 1909, this boat was three-fourths completed.

The amount expended to June 30, 1909, is $16,970.06, of which $10,470.06 was applied to maintenance. The expenditures during the past fiscal year were for commercial statistics, construction and inspection of boat.

On June 30, 1909, the maximum draft that could be carried over the bar at the mouth of the Chefuncte River was 7 feet, the expenditures for improvement having resulted in an increase of 2½ feet in depth and 60 feet in width. The head of navigation is Covington, on the Bogue Falia, about 16 miles by river from Lake Pontchartrain. The upper part of the stream is so crooked that boats 200 feet long can run only 12½ miles up the river and boats 110 feet long only 15 miles. The variation in level of water surface between high and low tide is usually about 1 foot, although winds may make a variation of as much as 3 feet.

The only information obtained as to the effect of the project on freight rates is a statement from the secretary of the state railroad commission that Covington has reduced rates on account of the

navigation on that river. The amount estimated for expenditure in the fiscal year ending June 30, 1911, is intended for dredging and snagging operations and maintenance of improvement.

On page 395, Annual Report of Chief of Engineers for 1906, reference is made to previous reports on examinations and surveys of these streams.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31, 1899	97,789	.....	1,716
Calendar year—			
1899	156,500	.....	.....
1900	86,856	.....	69,644
1901	92,874	6,018	.....
1902	100,768	7,894	.....
1904	184,099	83,331	.....
1905	222,494	38,395	.....
1906	235,727	13,233	.....
1907	221,177	.....	14,550
1908	247,887	26,710	.....

(*b*) *Tickfaw River and tributaries, Louisiana.*—These streams—the Tickfaw, Blood, Natalbany, and Ponchatoula rivers—had a 9-foot channel, navigable for steamers and schooners for an aggregate distance of 38 miles, but obstructed by snags, logs, and overhanging trees.

The original project, adopted in 1881, provided for the removal of obstructions as far as appropriations would permit; estimated cost, $10,230. The existing project is for maintenance of improvement, and under these two projects the work has been carried on since 1881.

All obstructing deadheads were removed from the channel from the mouth of the Tickfaw River to Springfield on the Natalbany, and a channel was dredged across a point, which had been a serious obstruction to navigation, just above Springfield.

It is proposed to apply available funds toward the construction of a combined dredge and snag boat and to the operation of this boat for the removal of bars and such snags, logs, and overhanging trees as interfere with navigation. On June 30, 1909, the boat was three-fourths completed.

The amount expended to June 30, 1909, is $18,583.61, of which it is estimated $10,468.12 was applied to maintenance. The expenditures during the past fiscal year were for collection of commercial statistics, construction, and inspection of boat.

On June 30, 1909, the maximum draft that could be carried over the bar at the mouth of the Tickfaw River at mean low water was 6 feet. There is at all times water enough in the river to accommodate a draft of 10 feet. The usual tidal variation of level of water surface is about 6 inches, but winds effect a variation of from 1 to 2 feet.

Tickfaw River is navigable in fact to Kemps Landing, about 18 miles from its mouth in Lake Maurepas; Blood River to S. Tuckers Landing, about 4 miles; Natalbany River to the parish bridge just above Springfield, La., about 12 miles; Ponchatoula River to Wadesboro, La., about 5 miles. The expenditures for improvement have been confined to the removal of snags, logs, and other obstructions.

No railroad reaches these streams at any point where navigable and there is no competition in freight rates.

The amount estimated for expenditure in the fiscal year ending June 30, 1911, is intended for dredging and snagging operations and maintenance of improvement.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31, 1899	52,961		22,681
Calendar year—			
1899	79,300		
1900	55,540		23,760
1901	56,464	924	
1902	45,632		10,832
1904	86,302	40,670	
1905	45,429		40,873
1906	34,690		10,739
1907	44,350	9,660	
1908	41,101		3,249

(*c*) *Amite River and Bayou Manchac, Louisiana.*—Prior to improvement the Amite River was navigable for small steamers for a distance of 45 miles from its mouth and Bayou Manchac for a distance of 10 miles, but both streams were obstructed by snags, logs, and overhanging trees.

The original project, as adopted in 1880 and modified in 1883 and 1888, provided for the removal of obstructions in Bayou Manchac from Hope Villa to the Amite River and in the latter stream to Lake Maurepas (its mouth), at an estimated cost of $31,760.

Amite River was improved for a distance of 42 miles from its mouth and Bayou Manchac for a distance of 10 miles from its junction with the former stream. A turning basin was made at the upper limit of improvement in Bayou Manchac.

The work of maintenance has been carried out under the project of 1892 and subsequent projects.

The improvement is not considered permanent, as snags and logs will continue to accumulate and bars will continue to form at the mouths of the streams, thus obstructing navigation.

It is proposed to apply the available funds toward the construction of a combined dredge and snag boat and to the operation of the boat for the removal of bars and such snags, logs, and overhanging trees as interfere with navigation. On June 30, 1909, this boat was three-fourths completed.

The amount expended to June 30, 1909, is $46,924.22, of which it is estimated $22,023.50 was applied to maintenance. The expenditures during the past fiscal year were for collection of commercial statistics, construction, and inspection of boat.

On June 30, 1909, the maximum draft that could be carried at mean low water over the bar in Lake Maurepas at the mouth of the river was 6 feet. The usual tidal variation at mouth of river is 6 inches; the level of water surface in Bayou Manchac varies as much as 6 feet. Amite River is navigable in fact to the mouth of Bayou Manchac, a distance of 42 miles, and Bayou Manchac is navigable to Hope Villa, a distance of 10 miles.

The only information obtained as to the effect of the project on freight rates is a statement from the secretary of the state railroad commission that Hope Villa, on Bayou Manchac, has been granted a special tariff, with rates lower than normal ones.

The amount estimated for expenditure in the fiscal year ending June 30, 1911, is intended for dredging and snagging operations and maintenance of improvement.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31, 1909	60,305	5,556	
Calendar year—			
1899	59,850		
1900	25,400		34,450
1901	69,918	44,518	
1902	44,694		25,224
1904	120,851	76,157	
1905	43,371		77,480
1906	50,669	7,298	
1907	45,552		5,117
1908	43,558		1,994

CONSOLIDATED.

July 1, 1908, balance unexpended	$34,475.35
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	39,475.35
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	13,495.78
July 1, 1909, balance unexpended	25,979.57
July 1, 1909, outstanding liabilities	1,516.02
July 1, 1909, balance available	24,462.95
July 1, 1909, amount covered by uncompleted contracts	5,123.33
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

BAYOU LAFOURCHE, LOUISIANA.

Bayou Lafourche is an outlet of the Mississippi River, forming a junction with that stream 70 miles above New Orleans. It is about 105 miles long and flows into the Gulf of Mexico. In its original condition it was obstructed by logs, snags, and overhanging trees. The project of 1879 provided for the removal of such obstructions to improve low-water navigation. Work under this project was carried on until 1885, with appropriations aggregating $30,000.

The project of June 11, 1886, provided for the construction of a lock to connect the bayou with the Mississippi River and for dredging a channel 75 feet wide and 5 feet deep at mean low water of the Gulf, at an estimated cost of $450,000 and $8,000 annually thereafter

for maintenance. Work under this project was confined to dredging to maintain low-water navigation, the appropriations at any one time being insufficient to warrant the commencement of the lock and the exigencies of commerce not permitting a suspension of the dredging.

The project of 1886 was modified on September 23, 1896, and held in abeyance the construction of the lock, restricting operations to dredging to maintain low-water navigation, at an estimated cost of $25,000 per annum.

Dredging operations have been in progress since 1896, but the improvement is not permanent, as sand bars form each year after the subsidence of floods in the Mississippi River.

The amount expended on this work up to June 30, 1909, was $258,085.17.

The navigation of Bayou Lafourche is at present obstructed by a dam placed across the head of the bayou at its junction with the Mississippi River by levee boards of the State of Louisiana, under authority of the act of Congress approved June 13, 1902. The time for the removal of this dam was extended to January 1, 1910, by the river and harbor act of March 2, 1907.

The depth of water in the bayou is practically the same as last year, which was at mean low tide 3½ feet at the mouth, the usual variation of the water surface being between one-half and 1 foot. The bayou is navigable its entire length by flatboats and log rafts, but, as stated above, connection between the bayou and the Mississippi River is at present cut off by a dam.

The commerce of this bayou is carried principally by small gasoline boats that ply between New Orleans and points along the bayou by way of Barataria Canal.

The effect of the project on freight rates is not definitely known.

It is proposed to expend the amount requested either in dredging, should the dam be removed, or in expenses of superintendence, inspection, etc., should the lock be built by the state levee boards, and in dredging.

Comparative statement of receipts and shipments for ten years.

Calendar year.	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
1899	157,258	.....	49,258
1900	210,315	53,057	.....
1901	137,257	.....	72,958
1902	132,745	.....	4,612
1903	94,351	.....	38,394
1904	66,839	.....	27,512
1905	94,320	27,481	.....
1906	59,092	.....	35,228
1907	46,413	.....	12,679
1908	64,914	18,501	.....

July 1, 1908, balance unexpended	$1,914.83
June 30, 1909, amount carried to the surplus fund	1,914.83
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	15,000.00

BAYOU PLAQUEMINE, GRAND RIVER AND PIGEON BAYOUS, LOUISIANA.

Prior to 1867 the largest steamboats could pass through Bayou Plaquemine into Grand Lake and other connecting water routes, but at that time the police jury of Iberville Parish closed the bayou by means of a dam, shutting out the waters of the Mississippi. Grand River and Pigeon bayous were obstructed by snags, logs, overhanging trees, and sand bars.

The present project is based upon legislation by Congress, according to project and estimate submitted February 11, 1887, and provides for dredging a channel in Bayou Plaquemine 60 feet wide and 6 feet deep from deep water up to the Plaquemine dike, constructing a lock to connect the bayou with the Mississippi River, securing the mouth of the bayou from further caving, and removing obstructions from Grand River and Pigeon bayous; total estimated cost, $1,708,250, subsequently increased to $1,740,000.

The project of 1887 was modified on April 10, 1899, to allow for dredging Bayou Plaquemine to a depth of 10 feet and a width of 125 feet.

The protection of the bank of the Mississippi River at the head of the bayou was added to the improvement in 1888, and in act of July 13, 1892, the improvement of Grand River and Pigeon bayous was also incorporated therein.

The act of June 3, 1896, authorized continuing contracts to be made to complete the project of improvement not to exceed $1,173,250, exclusive of the amounts therein and previously appropriated. Of this amount $1,160,000 was subsequently appropriated. By act of March 3, 1905, $35,000 was appropriated for maintenance of improvements, and contracts not to exceed $100,000, exclusive of the amounts theretofore appropriated, were authorized for completing improvement. The latter amount was appropriated by sundry civil act of June 30, 1906.

The river and harbor act of March 2, 1907, appropriated $100,000 "for construction of a dredge and maintenance."

The river and harbor act of March 3, 1909, appropriated $50,000 for maintenance.

Contract for the rectification of Bayou Plaquemine under the modified project of April 10, 1899, was made July 15, 1899. To June 30, 1909, 520,460 cubic yards of material were removed in accordance with the terms of the contract. In addition, 16,500 cubic yards was removed under supplemental contract from a portion of the channel which had shoaled. A partial channel was dredged through portions of the bayou up to the dike at the bayou approach to the lock, and work was suspended on June 27, 1905, until the lock should be opened to navigation. Work of dredging was resumed at the river end of the lock April 30, 1909.

An allotment of $75,000 was made from the appropriation of 1888 for securing the bank of the Mississippi River at the head of the bayou. Five submerged spur dikes, placed at intervals of about 900 feet, with intervals protected by revetment, were completed in 1894. These dikes and revetments form a continuous protection 1,400 feet long below the site of the lock and 1,200 feet above, with an interval of 500 feet opposite the lock site left for excavating the necessary channel to the lock. On November 30, 1901, and January 29, 1902,

two mattresses, 400 by 600 feet and 400 by 450 feet, respectively, were sunk in the river and heavily loaded with stone for protection of the banks near the proposed approach to the lock.

In 1891 a project for the construction of a lock was submitted, but the funds available were insufficient to warrant its commencement at that time. The Board of Engineer officers appointed to prepare plans and specifications estimated the cost of the lock at $700,000. Revised plans and specifications for the construction of the lock and approaches were approved October 27, 1897, and December 2, 1897, respectively, and a continuing contract for the work was made May 28, 1898. The work was commenced in August, 1898. Under this contract the floor and walls of the lock were completed, and miter sills, inlet pipes, and snubbing hooks placed. By direction of the Chief of Engineers the contract was annulled upon payment of the retained percentages and other items, aggregating $24,236.41. Revised plans for construction of lock gates and of the approaches to the lock, including excavation and fill, were approved on June 11, 1903.

For the approach to the lock 1.25 acres of land on the north side and 0.31 acre on the south side were purchased August 24, 1900, for $7,500.

A protection levee was built, under contract, from the northeast corner of the lock to connect with the main levee system in front of the lock. The work was completed August 8, 1902.

The contract for the lock gates was completed May 5, 1906, the gates being accepted on that date.

The contract with the Otis Elevator Company, dated November 18, 1899, for furnishing and erecting operating machinery and power house was completed August 31, 1906. The total cost of the work under this contract was $114,000.

A contract was made February 13, 1905, for constructing protection levee and making a portion of the fill behind the lock walls. The work was commenced in March, 1905, and was completed January 28, 1907. The total quantity of material placed under this contract was 39,940 cubic yards, costing $23,564.60.

A contract was made June 6, 1905, for construction of the approach at the bayou end and part of the approach at the river end of the lock. Work under this contract was commenced on October 10, 1905, and was completed in February, 1908. Under this contract there were excavated and placed behind the lock walls 65,729 cubic yards of material; 2,131 35-foot piles and 1,690 50-foot piles were driven; 9,855 cubic yards of concrete were placed in approach walls; 11 snubbing posts were placed; the total contract cost was $120,485.35.

A contract was made August 7, 1906, for excavation and construction of river approach and back fill of lock. Work under this contract was commenced in September, 1906, and at the end of the fiscal year a total of 14,600 cubic yards of earth had been moved from the old levee and placed in the protection levee at river end; 33,688 cubic yards of earth had been excavated and placed behind the lock walls, and 11,744 cubic yards had been excavated from the river approach and spoiled; 1,311 50-foot piles had been furnished and 1,100 driven; 2,643 cubic yards of concrete had been placed in approach walls, and 4,100 cubic yards of sand and gravel had been furnished. The total amount earned by the contractor was $72,382.88, of which $13,428.48 was expended during the fiscal year 1909.

By supplemental agreement dated September 28, 1908, the work of building river approach walls, and the work of driving piles, except two pile clusters, was stopped.

For maintaining the dredged channel through Bayou Plaquemine and Grand River and for removing sediment from the lock chamber the construction of a dredge was authorized by river and harbor act of March 2, 1907. In the estimate for this work it was proposed to expend $60,000 for the dredge and to operate same for two years at $15,000 per year; contingencies, $10,000.

A board appointed in May, 1907, to examine and report concerning this improvement recommended that the back filling behind lock and wing walls should be completed as soon as possible; that while it was being placed the lock walls should be tied together with steel rods and turnbuckles, and that as soon as the back filling was completed the lower lock gate should be calked and the lock filled with water and left so for at least a month, after which the lock should be emptied and the gates readjusted.

No proposals were received when bids for back filling were first opened, September 16, 1907. Placing of tie-rods was completed in October.

The Board was reconvened and renewed its recommendations that the back filling be completed as soon as possible, and recommended that additional tie-rods be placed in the vicinity of the quoins and gate recesses; also that a further appropriation of $50,000 be secured, if possible, for the completion of the lock and appurtenances.

On March 8, 1908, a supplemental contract was made with W. O. Burton & Co. for the back filling, which was commenced March 17 and completed April 28. A total of 24,203 cubic yards was placed, at a cost of $22,992.85.

On February 24, 1908, a contract was made with A. Baldwin & Co. for the extra tie-rods and turnbuckles, delivery to be completed March 17. The turnbuckles were not delivered until April 25, when the back filling was practically completed, and therefore the extra rods were not placed.

The calking of the lower gate was completed May 11, and pumping water into the lock commenced next day. It soon became apparent that the leakage under, around, and through the gate was so excessive that the dredge could not alone fill the lock, and two 18-inch siphons were installed. Later a cut was made in the levee and two 15-inch and one 18-inch pipe placed therein in order to allow direct flow of water from the Mississippi River into the forebay of the lock. On June 9 the depth of water in the lock was 43 feet, and this depth was maintained during the month for the water test recommended by the Board of Engineer officers.

This test was completed July 10, 1908, and the lock was unwatered, cleaned, and the gates readjusted. Water was let into the lock from the bayou on March 5, 1909, and from the river on March 12.

The sum of $1,704,224.45 had been expended on this improvement to June 30, 1909, including $1,000 withdrawn by the Chief of Engineers June 20, 1901, for office expenses, and $43.06, Treasury settlements April 13, 1908, and February 23, 1909, for transportation, and also including $32,318.15 expended in back filling and testing the lock in accordance with the recommendations of the Board of Engineers. Of the total amount it is estimated $17,371.66 was applied to the maintenance of the improvement.

The amount estimated for expenditure in the fiscal year ending June 30, 1911, is intended for maintenance of channel depths in the bayou by dredging and snagging.

Comparative statement of receipts and shipments for ten years.

Calendar year.	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
1899	111,750	22,449	
1900	88,543		23,207
1901	283,000	194,457	
1902	292,000	9,000	
1903	302,500	10,500	
1904	318,000	15,500	
1905	706,000	388,000	
1906	572,000		134,000
1907	534,744		37,255
1908	553,916	19,172	

July 1, 1908, balance unexpended		$275,775.83
Amount allotted from appropriation by river and harbor act approved March 3, 1909		50,000.00
		325,775.83
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$70,000.28	
June 30, 1909, amount reverting to Treasury and deposited to the credit of the appropriation for operating and care of canals, etc	169.13	
		70,169.41
July 1, 1909, balance unexpended		255,606.42
July 1, 1909, outstanding liabilities		15,453.34
July 1, 1909, balance available		240,153.08
July 1, 1909, amount covered by uncompleted contracts		140,431.05
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		10,000.00

LAKE PONTCHARTRAIN AND PASS MANCHAC, LOUISIANA.

The following reports of the Board of Engineers on recent surveys are concurred in by the Chief of Engineers and printed in House Documents numbered, respectively, 881 and 882, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., February 10, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

The district officer submits with favorable recommendation an estimate of cost amounting to $12,000 for removing from Lake Pontchartrain dangerous snags and logs, and an old breakwater near Milneburg, which is a menace to navigation. To keep the channel clear of obstructions after those now existing are removed will require an expenditure of about $500 per year.

After consideration of the benefits to commerce and navigation which may be expected from this work, as fully explained in the district officer's report on

the preliminary examination, the Board believes that the cost is reasonable and that it is advisable for the United States to undertake the improvement. It therefore unites with the division engineer in recommending approval of the project outlined within.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

While there is little or no commerce originating or terminating on Lake Pontchartrain, this body of water is an important link in a system of through transportation routes to and from the bayous tributary to it and to Lake Maurepas, which are engaged in commerce with New Orleans, Gulfport, Biloxi, Pascagoula, Mobile, and other points. It is estimated that the total value of this commerce is about $6,963,148.82, of which about 90 per cent is credited to the traffic with New Orleans. It is not expected that the removal of obstructions to navigation will have any appreciable effect on the commercial growth of the locality, but it will greatly facilitate commercial navigation and eliminate the existing dangers thereto.

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., February 10, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

In the within report the district officer estimates that the sunken logs obstructing Pass Manchac can be removed at a total cost of $6,000, and that after existing obstructions have been removed the improvement can be maintained by the expenditure of about $250 per year.

In reviewing the report of the district officer on the preliminary examination of this locality the Board gave a brief explanation of the benefits to commerce and navigation which may be expected from the work and, believing that its cost would be comparatively inexpensive, expressed the opinion that it would probably be advantageous for the United States to undertake the improvement. The information now available as to the expense involved confirms the Board in the opinion then conditionally expressed, and it therefore unites with the division engineer in recommending approval of the project outlined within.

Attention is invited to the recommendation of the district officer that if the plan of improvement of Pass Manchac and that of removing obstructions in Lake Pontchartrain be adopted the two works be included under the one appropriation title, "Improving Lake Pontchartrain and Pass Manchac, Louisiana." In view of the commercial relationship of these two projects and the similarity of the work required, this recommendation of the district officer would appear to be worthy of favorable consideration.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

The office of this pass is solely as a connecting link in a system of through transportation routes for commerce originating or terminating on the Amite, Tickfaw, and Blind rivers, and proceeding to or from New Orleans, Gulfport, Chefuncte River, and Bayou Bonfuca. Its improvement is therefore desired in the interest of a general commerce of some importance, the amount of which can not be precisely stated, but it is approximately indicated by statistics presented within.

MAINTENANCE AND IMPROVEMENT OF SOUTH PASS CHANNEL, MISSISSIPPI RIVER.

The act of Congress of March 3, 1875, amended by acts of June 19, 1878, and March 3, 1879, made provision for the construction by James B. Eads, or his representatives, of jetties and other works in South Pass to secure and maintain a channel 26 feet in depth through the pass, and through the jetties at the mouth of the pass a channel "twenty-six feet in depth, not less than two hundred feet in width at the bottom, and having through it a central depth of thirty feet without regard to width." A contract was made for the maintenance of such channel for a period of twenty years.

On January 28, 1901, this contract expired, and the work of maintenance is being continued under the provisions of the emergency river and harbor act of June 6, 1900, which provides that at the termination of the contract with the representatives of the estate of James B. Eads, deceased, the Secretary of War shall take charge of and maintain the channel, jetties, and auxiliary works at South Pass, for which a sum not to exceed $100,000 per year is appropriated until otherwise provided by law.

Additional appropriations amounting to $315,000 have since been made for the purchase of land at South Pass, for dredging, and for other necessary expenses to maintain the channel with the utmost efficiency. By act of May 28, 1908, Congress authorized the use of funds from this appropriation in dredging shoals in the river between Cubits Gap and Head of Passes, when necessary to secure a depth of 35 feet, with a practical width.

Dredging operations have been carried on with United States plant and the jetties and auxiliary works have been maintained in good condition by the addition from time to time, as required, of willows, stone, piles, and waling timber.

The lands along both sides of South Pass from Head of Passes to the Gulf, containing about 6,994 acres, together with the buildings thereon, were acquired by purchase July 8, 1903, the price paid being $35,000.

Experience has shown that in order to maintain the channel with the utmost efficiency and to meet the demands of the commerce of the port of New Orleans the amount of the annual appropriation authorized by the act of June 6, 1900, should be increased. If other funds than the $100,000 provided by the act of June 6, 1900, had not been available during the past fiscal year it would have been necessary to suspend dredging operations and the work of maintaining the channel would have been considerably curtailed. During the period that it is necessary to keep South Pass open to navigation, or until the commerce is diverted through Southwest Pass by the opening of that channel to navigation, the annual appropriation should be at least $180,000. It is believed that after the Southwest Pass is opened to navigation the work of maintaining the channel through South Pass may be discontinued.

The sum of $1,028,412.26 was expended on this work from January 29, 1901, to June 30, 1909.

Comparative statement of receipts and shipments for eight years for the port of New Orleans, La.

Calendar year.	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
1901	4,213,869	1,440,224	
1902	3,385,686		828,183
1903	3,062,506		323,180
1904	2,853,926		208,580
1905	3,478,976	625,050	
1906	4,023,156	544,180	
1907	3,527,097		496,059
1908	3,088,472		438,625

Since the United States took charge of the maintenance of the channel, January 29, 1901, there has been a general increase in the available navigable depth of 3 feet, the maximum draft that could be carried on June 30, 1909, being 29 feet.

The usual variation of level of water surface is from zero at the mouth to 2½ feet at the head of the pass, due to the stage of the river, and from 1.1 feet at the mouth to 0.7 foot at the head, due to tide.

No detailed data or statistics are at hand showing the effect on freight rates of the increased depth of channel. The number of deep-draft steamers has increased, and, being able to carry full cargoes, the earnings and business of the port of New Orleans have increased and the freight rates decreased. The magnitude of the commerce of the port of New Orleans is best illustrated by the tabulated commercial statistics above. These figures are necessarily incomplete, as it is impracticable to secure statements covering all the receipts and shipments for any given period. It may be safely assumed, however, that the total greatly exceeds that shown in the above comparative statement.

APPROPRIATION FOR FISCAL YEAR 1908.

July 1, 1908, balance unexpended	$14,189.18
June 30, 1909, amount expended during fiscal year	3,789.18
June 30, 1909, amount reverted to the Treasury during fiscal year	10,400.00

APPROPRIATION FOR FISCAL YEAR 1909.

July 1, 1908, amount appropriated by emergency river and harbor act of June 6, 1900	$100,000.00
June 30, 1909, amount expended during fiscal year for maintenance of improvement	89,300.60
July 1, 1909, balance unexpended	10,699.40
July 1, 1909, outstanding liabilities	2,563.90
July 1, 1909, balance available	8,135.50
July 1, 1909, amount covered by uncompleted contracts	8,135.50

APPROPRIATION, ACT OF MARCH 2, 1907.

July 1, 1908, balance unexpended	$15,802.17
June 30, 1909, amount expended during fiscal year	3,517.17
July 1, 1909, balance unexpended	12,285.00

MAINTENANCE OF SOUTH PASS CHANNEL, MISSISSIPPI RIVER (1909) (SUNDRY CIVIL ACT OF MAY 27, 1908).

July 1, 1908, balance available	$50,000.00
Transferred by Treasury Department from appropriation for repairs and incidental expenses of light-houses, 1909, on account of services rendered by Engineer Corps in making repairs to light-house wharf and beacon	97.45
Transferred by Treasury Department from appropriation for collecting the revenue from customs, 1909, on account of services rendered by the Engineer Corps in driving piles at customs wharf, Port Eads, La	44.10
	50,141.55
June 30, 1909, amount expended during fiscal year for maintenance of improvement	22,983.03
July 1, 1909, balance unexpended	27,158.52
July 1, 1909, outstanding liabilities	9,908.52
July 1, 1909, balance available	17,250.00
July 1, 1909, amount covered by uncompleted contracts	17,250.00

MAINTENANCE OF SOUTH PASS CHANNEL, MISSISSIPPI RIVER.

Amount allotted from appropriation by river and harbor act of March 3, 1909	*$80,000.00
July 1, 1909, balance available	80,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	*80,000.00

SOUTHWEST PASS, MISSISSIPPI RIVER.

On February 17, 1898, Congress allotted $10,000 from the appropriation for closing crevasse in Pass a Loutre, Mississippi River, for the purpose of a survey and report by a Board of Engineer officers upon the practicability of securing a channel of adequate width and 35 feet depth at mean low water of the Gulf of Mexico throughout Southwest Pass, Mississippi River. The survey was completed in 1898 and report submitted on January 7, 1899. This report is printed in the Annual Report of the Chief of Engineers for 1899, page 1863.

The item in the river and harbor act approved March 3, 1899, making appropriation for improving outlet of the Mississippi River provided for the appointment of a Board of Engineers to prepare a project for a channel 35 feet in depth throughout Southwest Pass and appropriated $20,000 for expenses of the Board. The Board of Engineers appointed under provisions of this act submitted a report and project on January 11, 1900. The report is printed on pages 2287–2302 of the Annual Report of the Chief of Engineers for 1900.

The project of the Board contemplated securing a channel 1,000 feet wide and 35 feet deep at mean low water throughout the Southwest Pass by dredging; the construction of two jetties to maintain the channel; the construction of sills across Cubits Gap, The Jump, and Baptiste Collets Canal; the closing of all minor out-

* This amount exclusive of regular annual appropriation of $100,000.

lets below the forts; the construction of a dredge in addition to the one provided for by the river and harbor act of March 3, 1899, and the sundry civil act of June 6, 1900, under appropriation for improveing outlet of the Mississippi River; other necessary plant, such as tugboats, barges, tracks, buildings, etc., and the purchase of land at the shore ends of the jetties; the whole estimated to cost $6,000,000, and $150,000 additional per annum for maintenance.

This project was adopted by the river and harbor act of June 13, 1902, which authorized material modifications in the plans of the jetties, and they are now located as shown on the map printed with Appendix S 1 of this report.

The original project for the expenditure of the funds appropriated for this work contemplated the construction of a dredge, dredging, purchase of land, and construction of two jetties to be built of mattresses and stone with concrete superstructure.

All of the land below or south of Pilottown, on the east bank, and all that below the United States reservation on the west bank of Southwest Pass, containing about 1,275 acres, were acquired on July 10, 1903, for use in connection with the work.

Contract was entered into July 16, approved July 31, 1903, for construction of the two jetties. The laying of foundation mats in the east jetty was commenced on December 31, 1903, and in the west jetty on August 30, 1904. The work under this contract was completed on January 5, 1908.

On account of the advance of the crest of the bar at Southwest Pass since the date of the survey of 1898, on which the estimates for this improvement were based, it became necessary to make provision for increasing the length of the jetties to correspond with this advance. This was done by supplemental contract dated July 18, 1905, the increased cost of the jetties on this account being estimated at $465,000. June 30, 1909, the jetties were completed; sills across Cubits Gap, The Jump, and additions to sill across the head of Pass a Loutre completed; coaling station and wharf at Burrwood completed; steel frame building 30 feet by 240 feet completed, and machines and ice plant installed therein now in operation.

Nine of eleven principal outlets from Southwest Pass into adjacent bays were closed by sheet-piling dams and five minor outlets closed.

The construction of 16 dwellings and 1 office building was commenced May 5, and is still in progress.

Dredging by contract was completed December 24, 1908, and that by government dredges continued.

By act of May 28, 1908, Congress authorized the use of funds from this appropriation in dredging shoals in the river between Cubits Gap and Head of Passes, when necessary to secure a depth of 35 feet with a practical width. The sum of $3,500,000 had been appropriated, and the river and harbor act of March 2, 1907, appropriated $1,000,000 additional, and authorized contracts to the further amount of $1,500,000, which was appropriated by sundry civil acts of May 27, 1908, and March 4, 1909. The river and harbor act of March 3, 1909, appropriated $275,000 and authorized that the sum of $600,000, or as much as may be necessary of the funds appropriated and authorized, be applied, in the discretion of the Secretary of War, to the construction of a suitable dredging plant.

In September, 1904, the available depth at mean low water was 8 feet.

In June, 1909, there was an available depth of 35 feet throughout the pass except as follows: On the bar, a distance of 2,500 feet between the 35-foot contours, with least depth of 22 feet; at mile 18, a distance of 300 feet, with least depth of 34 feet; at mile 13, a distance of 2,500 feet, with least depth of 26 feet.

Usual variations of water surface, 1.5 feet.

The length of Southwest Pass from its head to the present sea ends of the jetties is 19 miles.

The amount expended on this work to June 30, 1909, was $4,590,604.99.

The amount of money available and pledged and not covered by contracts at the end of the fiscal year is about sufficient to cover the cost of dredging with two dredges, expenses of administration and inspection, and reasonable contingencies. As recognized by the Board on Southwest Pass in its report of January 11, 1900, and as since borne out by experience, this work is "one more than ordinarily liable to special difficulties which do not admit of calculation, such as the effect of storms, unfavorable foundations, and uncertain action of the river current," and the amount of funds available for contingencies should be unusually large.

It is proposed to apply the additional appropriation asked for to the prosecution of dredging operations, by contract and otherwise, as may be found most economical and advantageous to the United States, with a view of obtaining a minimum depth of 35 feet at mean low tide, as contemplated by the original project; to the removal of the Eads sill at the head of the pass; to the construction of the plant that will be necessary in the maintenance of the improvement, and to the payment of other expenses pertaining to the general work of improvement under the approved project.

Rules and regulations for the navigation of Southwest Pass, Mississippi River, were prescribed May 29, 1909, by the Secretary of War, in pursuance of the provisions of section 5 of the river and harbor act approved March 3, 1909, to take effect and be in force on and after July 1, 1909.

July 1, 1908, balance unexpended	$1,672,845.32
Amount allotted from appropriation by river and harbor act approved March 3, 1909	275,000.00
Amount appropriated by sundry civil act approved March 4, 1909	330,000.00
Miscellaneous receipts deposited to the credit of the appropriation during fiscal year	2,745.03
Transferred by Treasury Department from appropriation for repairs and incidental expenses of light-houses, 1909, on account of coal furnished to the Light-House Department by the Engineer Corps	245.10
	2,280,835.45
June 30, 1909, amount expended during fiscal year, for works of improvement	615,682.16
July 1, 1909, balance unexpended	1,665,153.29
July 1, 1909, outstanding liabilities	34,056.75

July 1, 1909, balance available	$1,631,096.54
July 1, 1909, amount covered by uncompleted contracts	56,751.03
Amount (estimated) required for completion of existing project	[a]600,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	[b]950,000.00

BAYOU TECHE, LOUISIANA.

Bayou Teche is an important commercial stream of southern Louisiana, and finds its outlet into the Gulf of Mexico through Atchafalaya River. Prior to improvement it had a depth of 8 feet to St. Martinville, La., but navigation was rendered dangerous by numerous obstructions. Above St. Martinville the bayou was navigable by steamboats during high water. The project of 1870 provided for removal of obstructions from the head to the mouth of the bayou. Work under this project was carried on from 1870 to 1886, the stream being cleared of logs, snags, wrecks, overhanging trees, and a number of bars. The improvement was not permanent and other obstructions formed.

The project of 1891 provided for the removal of obstructions between St. Martinville, La., and the mouth of the bayou, a distance of about 80 miles. Work under this project has been carried on since 1891, obstructions being removed as appropriations were made.

The project was modified by the river and harbor act approved March 2, 1907, with a view to obtaining a 6-foot navigation to Arnaudville, in accordance with the report submitted in House Document No. 527, Fifty-ninth Congress, first session, at an estimated cost of $111,000, by dredging, removal of snags, etc., and construction of a lock. The expenditure for a 6-foot navigation to Arnaudville is contingent upon all lands necessary for lock and dam purposes and canal feeders being deeded to the United States free of cost and upon the United States being secured against possible claims for damages resulting from the overflow of lands by reason of the lock and dam improvement or from the draining of Spanish Lake.

To guarantee the United States against any claims for overflow, bonds were issued by municipalities in St. Martins Parish to the amount of $10,000, but it was decided by the Acting Judge-Advocate-General that such bonds were invalid. An effort was made to secure bonds from responsible bonding companies, but bonds in perpetuity could not be obtained. The conditions of the act are now under consideration by the Judge-Advocate-General and Engineer Department, and it is probable that some way of fulfilling the requirement will be decided upon to permit the work to be started.

Proportion of the project completed: To June 30, 1909, no work of construction had begun. The maximum draft that can be carried is 4 feet. The variations of water level between high and low water is 12 feet (exceptional floods not included).

A deed of the land required for lock and canal feeders was forwarded to the Attorney-General for opinion as to the validity of title. It was

[a] This amount is estimated to construct a dredge to be used in completing the existing project, also to be used in maintenance of the improvement.

[b] Of this amount $600,000 is for continuing contract work authorized by the river and harbor act of March 3, 1909.

returned approved April 23, 1909, and was recorded May 1, 1909, in Book No. 70, pages 559–563, at St. Martinville, in the parish of St. Martin, La.

To June 30, 1909, $97,567.76 had been expended upon this work, of which $10,733.46 was for maintenance and $4,293.53 for expenses of resurvey of the bayou and $82,540.77 for works of improvement.

The maximum draft that could be carried June 30, 1909, was about 4 feet. The usual variation of level of water surface is not definitely known.

The bayou is navigable to St. Martinville, 75 miles from its mouth. The effect of the project on freight rates is not positively known.

It is proposed to apply the appropriation recommended to dredging shoals and removing obstructions in the channel as far up as the proposed site of the lock, 3½ miles below St. Martinville, La., and to removal of snags, overhanging trees, and other obstructions above that point and the construction of the lock and dam.

Comparative statement of receipts and shipments for ten years.

Calendar year.	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
1899	272,975		13,116
1900	212,109		60,866
1901	335,583	123,474	
1902	404,454	68,871	
1903	450,542	46,088	
1904	362,706		87,836
1905	701,243	338,537	
1906	706,091	4,848	
1907	580,216		125,875
1908	515,679		64,537

July 1, 1908, balance unexpended	$130,510.72
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	135,510.72
June 30, 1909, amount expended during fiscal year, for works of improvement	1,578.48
July 1, 1909, balance unexpended	133,932.24
July 1, 1909, outstanding liabilities	150.00
July 1, 1909, balance available	133,782.24
Amount (estimated) required for completion of existing project	40,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	60,000.00

BAYOU TERREBONNE, LOUISIANA.

Report on a recent survey is printed in House Document No. 1163, Sixtieth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 5, 1908.

SIR: I have the honor to submit herewith for transmission to Congress reports of July 13. 1907, and November 29, 1907, by Col. E. H. Ruffner, Corps of Engineers, on preliminary examination, with plan and estimate of cost of improvement authorized by the river and harbor act approved March 2, 1907, of Bayou Terrebonne, Louisiana, with a view to obtaining 6 feet of water.

Between 1880 and 1895 appropriations aggregating $38,800 were made for improving Bayou Terrebonne under a project which called for the dredging of a channel 4 feet at mean low water of the Gulf of Mexico up to the town of Houma. There is now more or less navigation on the bayou, but at Houma there is a width of only 20 feet and depth of 3 feet at low tide; the average range of the tide at that point is 8 inches.

In his report of November 29, 1907, Colonel Ruffner presents an estimate of $215,000 as the cost of obtaining a channel 60 feet wide and 6 feet deep at low tide in the part of the bayou at and below Houma, where that depth does not now exist. In his opinion the expenditure of this amount is justified by the commercial interests involved.

The matter has been referred, as required by law, for review by the Board of Engineers for Rivers and Harbors, and attention is respectfully invited to the Board's final report on the subject, dated July 6, 1908 (also herewith). From the facts and for the reasons given the Board is led to conclude that a channel with a depth of 6 feet and of navigable width can be obtained over the 24 miles of the bayou requiring improvement at a cost of not exceeding $50,000; that such a channel will afford facilities equal to those of the connecting waterways and meet all reasonable demands for the present and the near future, and that the expenditure of this sum by the General Government in the further improvement of Bayou Terrebonne is warranted by the benefits which may be expected to result to general commerce. The Board recommends, therefore, that an appropriation of this amount be made for the purpose of this improvement, provided that any land needed for extra width of channel for depositing dredged material shall be first deeded to the United States free of cost.

I concur in the views and recommendations of the Board of Engineers for Rivers and Harbors.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

THE SECRETARY OF WAR.

The locality affected by the improvement of this stream is largely devoted to the raising of sugar cane, and one large refinery is entirely dependent upon it for transportation.

This section of country is developing very rapidly, and there are evidences of a substantial growth which leads to the belief that with suitable facilities to Houma the water-borne commerce, which is now considerable, will be materially augmented in the future. Substantial expenditures have been made by private interests for the improvement of the waterways in this locality. Statistics appended to the report of the district officer indicate that a substantial commerce in cotton, lumber, potatoes, oysters, etc., originates in this vicinity. Interested parties estimate the value of prospective receipts at $5,000,000, and the value of prospective shipments at $12,812,000. A steamer operates between Houma and New Orleans by way of a private canal, and there is more or less navigation from Houma to the Gulf.

CHANNEL, BAY, AND PASSES OF BAYOU VERMILION, AND MERMENTAU RIVER AND TRIBUTARIES, LOUISIANA.

(a) *Channel, bay, and passes of Bayou Vermilion.*—Prior to improvement the upper 12 miles of Bayou Vermilion was only 2 feet deep, and its lower portion, through the bay and passes, not less than

5½ feet deep, and had a width varying from 100 to 400 feet. The channel, however, was obstructed by snags, logs, and overhanging trees.

The original project, adopted in 1880, provided for the removal of snags and for dredging, at an estimated cost of $9,900. A modified project, adopted in 1892, provided for securing a navigable depth of 5½ feet up to the railroad bridge near Lafayette, La., and for the erection of guide piling to mark the channel from the mouth of the bayou to Vermilion Bay, a distance of about 5 miles, at an estimated cost of $25,000. Project for maintenance was adopted in 1905.

The improvement is not considered permanent, as obstructions will continue to form and must be periodically removed.

It is proposed to apply the available funds toward the construction of a combined dredge and snag boat and to the operation of said boat for the removal of bars and such snags, logs, and overhanging trees as interfere with navigation. On June 30, 1909, the boat was three-fourths completed.

Operations were carried on by the steamer *Hyacinth* between June 11 and 18, 1908, for the removal of snags and other obstructions below Abbeville, La.

The amount expended to June 30, 1909, is $40,784,16, of which amount $30,884.16 has been expended for maintenance. The expenditures during the past fiscal year were for collection of commercial statistics and construction and inspection of boat.

On June 30, 1909, the maximum draft that could be carried over the bar at mouth of Bayou Vermilion was about 3 feet and in the upper part of the stream 2½ feet. The usual tidal variations at mouth of bayou is about 1 foot and in upper part about 18 inches. The bayou is navigable to D. O. Broussard's landing, about 20 miles above Abbeville, La., or 46 miles from mouth, although it is obstructed by snags and logs.

The only information obtained as to the effect of the project on freight rates is a statement from the secretary of the state railroad commission that at Abbeville there are lower rates than to intermediate points, on account of its being located on navigable water.

The amount estimated for expenditure in the fiscal year ending June 30, 1911, is intended for dredging and snagging operations.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31, 1899	14,969	6,107	
Calendar year—			
1900	21,150	6,181	
1901	31,385	10,235	
1902	37,000	5,615	
1903	15,157		21,843
1904	29,326	14,169	
1905	28,092		1,234
1906	32,025	3,933	
1907	37,515	5,490	
1908	26,589		10,926

On page 399, Annual Report of Chief of Engineers for 1906, reference is made to previous reports on examinations and surveys of this stream.

Reports on preliminary examination and survey to Lafayette with a view to obtaining 6 feet of water, required by act of March 2, 1907, were submitted on January 21 and August 10, 1908, and are printed in House Document No. 1218, Sixtieth Congress, second session. (See summary following.)

(*b*) *Mermentau River and tributaries, Louisiana.*—Prior to improvement these streams had depths varying from 7 to 30 feet. The channel through Grand Lake was 6 feet deep, and the depth at the mouth of the river was about 13 feet. The width varies from 70 feet, near Viterboville, to 350 feet at Lake Arthur. The channel was crooked and obstructed by snags and logs.

The original project of 1892 provided for the removal of obstructions in the upper river and the construction of brush dams in the lower river to remove existing mud flats. The estimated cost was $23,615.25.

With the appropriations of 1892, 1894, and 1896 operations were carried on from December, 1892, to December, 1899, and 38 miles of the channel, from the lower end of Lake Arthur downstream, was cleared of obstructions; two brush dams, 2,500 and 3,000 feet in length, respectively, were built in Mud Lake, and a channel 8 feet in depth and 50 feet in width was cut across the flats in Mud Lake and maintained as the exigencies of navigation required.

An examination made in July, 1906, showed that Bayou Nezpique, the principal tributary, was obstructed with snags and logs, and that dredging would probably be required for maintenance of the channel through Grand Lake and Lower Mud Lake. Operations were commenced in Bayou Nezpique with a hired plant on August 21, 1906, and were completed on October 6, 1906. All obstructing snags and logs were removed from the channel for a distance of 21 miles below Viterboville, La.

It is proposed to apply the available funds toward the construction of a combined dredge and snag boat and to the operation of this boat for the removal of such bars, snags, logs, and overhanging trees as interfere with navigation. On June 30, 1909, this boat was three-fourths completed.

The amount expended to June 30, 1909, is $32,504.13, of which it is estimated that $15,787.65 was applied to maintenance. The expenditures during the past fiscal year were for collection of commercial statistics, construction, and inspection of boat.

On June 30, 1909, the maximum draft that could be carried over the flats in Lower Mud Lake, the shoalest place in the channel, was 4 feet at mean low water. The usual variation of the level of water surface in the lower reaches of the river is about 1½ feet, and the extreme variation is about 2½ feet. Mermentau River is navigable throughout its whole length to about 2 miles above Mermentau, a distance of about 70 miles; Bayou Nezpique, the principal tributary, is navigable to Viterboville, La., a distance of about 25 miles above the head of the Mermentau River; Bayou Plaquemine Brule and Bayou des Cannes are each navigable for distances of about 10 miles, and Bayou Queue de Tortue for about 12 miles.

The only information obtained as to the effect of the project on freight rates is a statement from the secretary of the state railroad commission that at Mermentau there are lower rates than at intermediate points, on account of its being located on navigable water.

The amount estimated for expenditure in the fiscal year ending June 30, 1911, is intended for dredging and snagging operations.

Comparative statement of shipments and receipts for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31, 1899	22,236	3,586	
Calendar year—			
1900	27,084		
1901	29,291	2,257	
1902	50,326	21,035	
1903	63,690	13,364	
1904	45,866		17,824
1905	42,413		3,453
1906	61,634	19,221	
1907	49,756		11,878
1908	44,382		5,374

On page 401, Annual Report of Chief of Engineers for 1906, reference is made to previous reports on examinations and surveys of this stream.

Reports of examination with plan and estimate of cost of improvement of Bayou Plaquemine Brule, required by act of March 2, 1907, were submitted December 19, 1907, and February 8, 1908, and are printed in House Document No. 789, Sixtieth Congress, first session. (See summary following.)

The act of March 3, 1909, calls for a preliminary examination of Bayou Queue de Tortue, report on which is printed in House Document No. 609, Sixty-first Congress, second session. (See summary following.)

CONSOLIDATED.

July 1, 1908, balance unexpended	$25,098.09
Amount allotted from appropriation by river and harbor act approved March 3, 1909	4,000.00
	29,098.09
June 30, 1909, amount expended during fiscal year for maintenance of improvement	9,371.13
July 1, 1909, balance unexpended	19,726.96
July 1, 1909, outstanding liabilities	973.86
July 1, 1909, balance available	18,753.10
July 1, 1909, amount covered by uncompleted contracts	4,318.34
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	6,000.00

BAYOU VERMILION, LOUISIANA.

Report on a recent survey is printed in House Document No. 1218. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 5, 1908.

SIR: I have the honor to submit herewith for transmission to Congress reports of January 21, 1908, by Maj. James F. McIndoe, Corps of Engineers, and of August 10, 1908, by First Lieut. Wildurr Willing, Corps of Engineers, on preliminary examination and survey, respectively, authorized by the river and harbor act approved March 2, 1907, of Bayou Vermilion, Louisiana, to Lafayette, with a view to obtaining 6 feet of water.

Work of improving Bayou Vermilion has been carried on for some years under a project which provided for securing a navigable depth of 5½ feet up to Lafayette; but this project has never been completed and for some time operations have been confined to work of maintenance only.

As a result of the present investigation it appears that the commercial interests involved are not sufficient to warrant the expenditure necessary to obtain a depth of 6 feet up to Lafayette, nor even the depth of 5½ feet contemplated by the existing project.

In his survey report of August 10, 1908, Lieutenant Willing submits a plan for modified improvement which would make Bayou Vermilion navigable as far up as Lafayette for boats drawing 3 feet for a period of about eight months in the year, and would cost approximately $22,660, and $3,000 per annum for maintenance after completion.

I concur in the opinion of the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors that Bayou Vermilion is worthy of improvement to this limited extent.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

The following boats are at present engaged in business on Bayou Vermilion: Steamer *Joe B. Chaffe* and 14 barges, about 50 small sailing vessels, averaging 7 tons each, and 10 gasoline boats of about 10 tons each.

These are said to carry about 37,000 tons of freight, valued at $715,000, to and from Abbeville annually.

BAYOU PLAQUEMINE BRULE, LOUISIANA.

Bayou Plaquemine Brule is a tributary of the Mermentau River, which it enters at a point about 5 miles above the town of Mermentau. The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 789, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., February 24, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

It is the opinion of the district officer that the only improvement of Bayou Plaquemine Brule justified by present and prospective commercial interests is the removal of snags, logs, overhanging trees, or other obstructions to provide a clear channel width of 60 feet and a depth of about 6 feet, beginning at the mouth of the bayou and extending upstream to a point near Crowley, a distance of approximately 29 miles. The cost of such an improvement is estimated to be $10,000, and the cost of its maintenance about $250 per annum.

In the opinion of the Board the benefits to be expected from the improvement proposed by the district officer and the division engineer are sufficient to justify the expenditure required for its accomplishment. Approval of the project is therefore recommended.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

Following is extracted from the report of the local engineer:

Interviews were had with several of the prominent citizens of Crowley who have been identified with her progress. From these gentlemen it is learned that Crowley is the center of the rice section of Louisiana and has a population of 7,000. There are at present in operation 9 rice mills, with a combined annual milling capacity of 800,000 sacks of rough rice of 185 pounds each, representing a tonnage of 74,000 tons and a valuation of rough rice of about $3,000,000.

Every pound of this rice is brought into Crowley by carts or by railroad. Mr. W. H. Hunter, president of the Hunter Canal Company which furnished water to 23,000 acres of rice land, states that 100,000 sacks of rice grown on the fields irrigated by his company are hauled by wagon to the mills at Crowley; that the average haul is 16 miles and that the average cost of hauling is 22 cents per sack. If navigation were opened to Crowley all of this rice would be taken by water at a cost of about 12 cents per sack.

Capt. Geo. W. Caldwell, owner of tugs and barges plying on Mermentau River and tributaries, states that he brings annually about 30,000 sacks of rough rice 90 miles by water to Mermentau Station and places them on board cars there for shipment to Crowley for 10 cents per sack. The Southern Pacific Railroad charges 9 cents per sack for hauling it to Crowley, a distance of 13 miles, and if navigation were opened he could bring this rice to Crowley at a total cost of 12 cents per sack, 7 cents per sack less than present rates. It is his opinion that if the stream is improved much rice now sent by rail from the vicinity of Lake Arthur to be milled at Lake Charles would come by water to Crowley, in view of the high freight rates on branch line from Lake Arthur to Lake Charles.

Mr. John Green, secretary of the Crowley Rice Mill, estimates that fully 60 per cent of the 800,000 bags of rice which annually are shipped to Crowley to be milled would come by the water route, at a saving of from 7 cents to 10 cents per sack on freight.

The benefits to be derived from the proposed improvement are not limited to the better freight rates on rice alone. It is pointed out that Crowley has no cheap way of getting sand, shells, and lumber; that the opening up of Bayou Plaquemine Brule will give her communication with sawmills on the navigable part of that stream and on Mermentau River; that it will place her in water communication with shell banks and sand banks contiguous to Mermentau River; that it will give her a cheap means of getting wood fuel which is no small item to a town of 7,000 people.

Business men feel that there is unjust railroad discrimination against Crowley and submit the following comparative rates, at the same time emphasizing the fact that there is a difference of only 52 miles in the haul and that in some instances Crowley has the shorter haul.

BAYOU QUEUE DE TORTUE, LOUISIANA.

Report on a recent survey is printed in House Document 609, Sixty-first Congress, second session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., December 20, 1909.

Respectfully returned to the Chief of Engineers, U. S. Army.

The district officer, who is also the division engineer, recommends favorably a project of improvement which provides for snagging, the removal of obstructions, overhanging trees, etc., and the formation by dredging of 10 cut-offs apparently to conform in size to the present navigable width and depth of

the stream, for a distance of about 19½ miles. The estimated cost of the work involved is $25,000. While it seems impracticable to submit a definite estimate for future maintenance, the district officer believes that $1,000 annually will be sufficient to cover this item.

The amount of present commerce is reported in the accompanying letter of Mr. H. L. Gueydan to be 22,253 tons, valued at $355,125, and the district officer states that this amount may reasonably be expected to increase in the future. In the opinion of the Board, the improvement proposed by the district officer is advisable in connection with work on the Mermentau, provided the necessary right of way for the cut-offs is furnished free of cost to the United States. With this proviso, it recommends that the improvement be undertaken by the General Government.

Referring to the special subjects to be considered under section 13 of the act of March 3, 1909, it appears that the commerce on this waterway is distributed at a number of small landings and irrigation plants, and that no special terminal facilities or appliances exist or are necessary; and, further, that there are no questions of water power or allied subjects so related to the project for improvement at this locality as to be coordinated therewith to lessen its cost and compensate the Government for the expenditures proposed.

For the Board:

WM. T. ROSSELL,
Colonel, Corps of Engineers,
Senior Member of the Board.

INLAND WATERWAY FROM FRANKLIN TO MERMENTAU, LA.

The project for this waterway was adopted by Congress March 2, 1907, and provides for a channel 5 feet deep and 40 feet bottom width, with appropriate side slopes. The channel proposed was to run from Bayou Teche near Franklin, La., to Cote Blanche and Vermilion bays by a dredged canal and existing drainage canals or bayous, thence up Schooner Bayou, thence by a dredged canal to White Lake; across White Lake, thence by a dredged canal to Grand Lake and across this lake to Lake Misere, west of the Mermentau River, at an estimated cost of $289,292, with an estimated cost for maintenance of $20,000 per year. The construction of a lock at a suitable point between Vermilion Bay and White Lake has been found necessary for the purpose of regulating the flow through the canal, with a view to preventing damage to rice lands by reason of contamination of the which since has been appropriated.

The act of March 2, 1907, appropriated $89,292, and contracts were authorized to complete the project not to exceed $200,000, all of which has since been appropriated.

Under the general project the right of way must be furnished without cost to the United States.

The proposed waterway must cross the right of way of the Southern Pacific Railroad, and a bridge for the service of the railroad will be necessary. The War Department has decided that the cost of this bridge must be borne by the United States.

The amount expended to June 30, 1909, is $14,183.02, for inspections of the various routes and for surveys and dredging.

The available balance and the appropriation recommended for the fiscal year 1911 will be applied to completion of dredging and maintenance of improvement, in accordance with the adopted project.

The report on the examination of the inland-waterway channel is printed in House Document No. 640, Fifty-ninth Congress, second session.

A change of the route between Vermilion Bay and the Teche was authorized by the river and harbor act of March 3, 1909.

The field work on preliminary examinations and surveys for determining the best route for this section of the canal were completed on June 11, but the selection of the route for this portion of the canal is so intimately connected with that for the deeper canal, for which Congress authorized a survey by the river and harbor act of March 3, 1909, that it must necessarily be practically determined by the latter. It would be poor policy to locate the 5-foot canal on a line which would not permit its subsequent enlargement to the 9-foot canal proposed.

July 1, 1908, balance unexpended		$182,377.08
Amount appropriated by sundry civil act approved March 4, 1909		100,000.00
Receipts from sales of blueprints during fiscal year		5.50
		282,382.58
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$7,262.44	
Amount withdrawn through Treasury settlement	5.66	
		7,268.10
July 1, 1909, balance unexpended		275,114.48
July 1, 1909, outstanding liabilities		796.32
July 1, 1909, balance available		274,318.16
July 1, 1909, amount covered by uncompleted contracts		66,976.88
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		25,000.00

WATERWAY, MERMENTAU RIVER TO SABINE RIVER, LOUISIANA AND TEXAS.

The following is printed in Rivers and Harbors Committee Document No. 3, Sixty-first Congress, second session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., December 21, 1908.

DEAR SIR: 1. The Board of Engineers for Rivers and Harbors has the honor to submit its report in response to the following resolution:

"*Resolved by the Committee on Rivers and Harbors of the House of Representatives*, That the Board of Engineers provided for in section three of the river and harbor act of June thirteenth, nineteen hundred and two, shall be requested to examine and review the report of Maj. Edgar Jadwin upon the inland waterway from the Rio Grande River, Texas, to a connection with the Mississippi River, made in pursuance of the river and harbor act of March third, nineteen hundred and five."

2. The report referred to in the resolution is published as House Document No. 640, Fifty-ninth Congress, second session. Said report is in considerable detail and covers the general questions involved so thoroughly that it does not seem to be necessary to describe the project at this time. On December 22, 1906, when reviewing the report on the preliminary examination of this waterway, the Board recommended the improvement of three sections, namely, Aransas Pass to Pass Cavallo, Brazos River to Galveston, Tex., and Franklin on Bayou Teche to the Mermentau River, Louisiana, at a total estimated cost of approximately $500,000 and $50,000 annually for maintenance. It is understood that the present inquiry is with a view to determining the advisability of improving other sections of this waterway.

3. The Board has given further study to this subject and on June 18, 1908, held a duly advertised public hearing at Lake Charles, La., and one at Galveston, Tex., on June 19, in reference to this improvement. These meetings were attended by a large number of persons, who displayed great interest in the

subject and presented a number of written and oral arguments in behalf of an extension of the work already provided for.

4. The information made available by the investigation of the Board indicates a remarkable development throughout the greater part of the country traversed by the proposed canal route. It appears that the production in the adjacent country has so increased that it now exceeds the ability of the railroads to handle the output and that considerable loss and hardship are experienced through congested freight conditions and high freight rates.

5. Further study of the subject led the Board to believe that the present and prospective commerce involved was sufficient to warrant the improvement of the section from the Mermentau River to Sabine River, Louisiana, and from the Brazos River to Pass Cavallo, Texas, and it recommended that a further report be submitted by the district officers as to the cost of the work involved, the investigation indicating that he cost as formerly estimated might be somewhat reduced. Reports on these subjects have been submitted and are inclosed herewith. It appears that the estimate of the work in Louisiana to connect the Mermentau with the Sabine is practically the same as indicated in the original report, namely, $390,000. As no estimate for annual maintenance is included in the supplemental report, it is assumed that the original estimate of $20,000 still maintains. The Board, however, believes from information obtained by its committee that this estimate can be safely reduced to $300,000 for first cost, the estimate for maintenance being retained at $20,000 annually.

6. The further investigation and survey of the section from the Brazos River to Pass Cavallo, Texas, show a considerable reduction in the estimated cost of the work involved. Based on the preliminary report already submitted, the work was estimated to cost $552,497.60 and $20,000 annually for maintenance. With the more complete information now available, the district officer estimates the cost of improving this section at $400,000 and $15,000 annually for maintenance.

7. The Board is now of opinion that the interests involved are sufficient to warrant the improvement of these two sections at the above estimated cost, wih the proviso that all necessary rights of way be given free of cost to the United States. It believes that some latitude should be allowed in the final location of the canal line and that the route as now proposed should be considered as approximate only. The Board is of opinion that the sections from the Rio Grande to Aransas Pass and from Galveston to the Sabine are not worthy of improvement at the present time, believing that neither one would give returns commensurate with the cost. If the improvement already undertaken and that recommended herein are carried to completion a large territory in southwest Texas will have communication by a sheltered route with the port of Galveston, and southern Louisiana will have access to two ports, one at New Orleans, the other at Port Arthur and Sabine.

For the Board:

Very respectfully,

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

The CHIEF OF ENGINEERS, U. S. ARMY,
Washington, D. C.

REMOVING THE WATER HYACINTH FROM WATERS IN LOUISIANA AND TEXAS.

Under the provisions of the sundry civil act of June 4, 1897, a board of engineer officers, appointed to investigate the extent of obstruction to navigation in the streams of Florida and Louisiana and to determine a method of checking the growth of or removing the water hyacinth, recommended the construction of boats fitted with crushing machinery and the use of log booms as adjuncts to the boats. (See Annual Report of the Chief of Engineers for 1899, p. 1615.)

Under the act of March 3, 1899, $25,000 was appropriated for the purchase of a boat, $1,000 for the construction of log booms, and $10,000 for operating expenses.

A boat purchased and fitted with machinery for crushing the hyacinths was operated in Bayou Plaquemine and contiguous streams

from July, 1900, to June, 1901, when funds were exhausted. Approximately 188,800 square yards of plants was removed.

A boom, with a suitable gate to permit of the plants floating out with the tides and to prevent their return, was constructed and placed at the mouth of Bayou Teche, Louisiana.

Act of June 13, 1902, permitted the destruction of the plants by chemical means or otherwise, and the boat was fitted with special machinery designed for spraying the plants with a chemical compound. Operations were carried on in this manner from September, 1902, to May, 1903, and from August to October, 1903. Approximately 522,750 gallons of the compound was sprayed over an area estimated at 3,509,024 square yards of hyacinths.

Bayou Plaquemine and contiguous streams were, at date of cessation of operations (October 26, 1903), practically free from hyacinths.

The steamboat *Ramos* began spraying operations July 8, 1904. When the season's operations were terminated, the following streams were effectively cleared of all obstructing hyacinths: Bayou Plaquemine, Grand River, Bay Natchez, Bayou Goddell, Belle River, Bayou Long, Bayou Grossetete, and Bayou Choctaw. Booms for controlling the hyacinths were placed in Bayou Plaquemine, at mouth of Bay Grossetete, at the head of navigation in Bayou Grossetete, and across Bayou Choctaw. During the summer months a watchman is maintained at the Bayou Plaquemine boom, whose duty it is to require all rafts and boats to clear themselves of hyacinths before passing through.

The act of March 3, 1905, appropriated $40,000 for the removal of the water hyacinths from the navigable waters of the State of Texas and Louisiana, and projects, approved April 28 and May 15, 1905, provided for continuance of spraying operations in the Plaquemine-Morgan City water route and for the outfitting of a second boat for operations in the Calcasieu River, Louisiana, and in the Sabine and Neches rivers, Texas.

Operations were resumed in Bayou Plaquemine April 8, 1905, and were continued until October 31 in this and connecting streams named above, at which date the condition of the streams between Plaquemine and Morgan City was sufficiently satisfactory to warrant the suspension of further spraying operations for the season. During the entire season a new chemical compound was used, which gave excellent results at greatly diminished cost. In the season's work a total of 227,292 gallons of chemical compound was used, at a cost for chemicals of $1,098.66. At the price paid in previous seasons for chemical compound this quantity would have cost $6,818.76. There was therefore a saving of over $5,700, which will pay the operating expenses of the *Ramos* and of the hyacinth booms for a season. It is estimated that each gallon of chemical destroyed approximately 10 to 12 square yards of hyacinths.

The steamboat *Hyacinth* (except the hull, which was purchased) was built and equipped by hired labor at the engineer depot at New Orleans at a total cost of $8,900.

During the fiscal year 1907 spraying operations were carried on in the streams of the Plaquemine-Morgan City route, resulting in clearing the streams of all obstructing hyacinths. Cow Bayou, a tributary of the Sabine River, Texas, and Bayou des Allemands and contiguous streams, which were completely blocked by hyacinths, were cleared.

In October, November, and December, 1906, the *Ramos* sprayed in Calcasieu River, in English Bayou, a tributary of the Calcasieu, and in Bayou Vermilion, but the season was too far advanced for good results.

During the working season of 1906, 265,409 gallons of chemical compound was sprayed, at a cost of $0.0051 per gallon raw. During the fiscal year ending June 30, 1908, operations were carried on in Bayou des Allemands, Bayou Barataria, Bayou Vermilion, and in the streams of the Plaquemine-Morgan City route.

During the working season of 1907, 507,622 gallons of chemical compound were sprayed, at a cost of $0.0055 per gallon raw, and in 1908, to June 30, 124,236 gallons, at a cost of $0.0041 per gallon raw.

During the fiscal year ending June 30, 1909, the *Hyacinth* worked in Bayou Vermilion, Little Bayou, Bayous Blue, des Allemands, Boeuf, Grand, Barataria, and Teche, destroying and removing hyacinths from these streams.

In addition to the usual watchman at the Plaquemine Bayou, one was also hired to operate a temporary boom in Bayou des Allemands.

During the working season of 1908, 281,956 gallons of chemical compound were used at a cost, raw, of $0.0040 per gallon.

During the season of 1909, 17,291 gallons have been used at a cost, raw, of $0.0034 per gallon.

The steamboat *Hyacinth* underwent extensive alteration and repairs from November 19, 1908, to May 24, 1909.

The amount expended to June 30, 1909, was $122,746.34.

The amount estimated for expenditures in the fiscal year ending June 30, 1911, is intended for operating boats for spraying plants and the installation of booms and hire of watchmen for their operation and maintenance.

July 1, 1908, balance unexpended	$9,627.21
February 24, 1909, amount allotted from appropriation for emergencies in river and harbor works, act of March 2, 1907	5,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	20,000.00
Miscellaneous receipts from sales of property, etc., deposited to the credit of appropriation	138.00
	34,765.21
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	11,782.56
July 1, 1909, balance unexpended	22,982.65
July 1, 1909, outstanding liabilities	692.06
July 1, 1909, balance available	22,290.59
Amount that can be profitably expended in fiscal year ending June 30, 1911, exclusive of the balance unexpended July 1, 1909	40,000.00

RED RIVER, LOUISIANA, ARKANSAS, TEXAS, AND OKLAHOMA.

(*a*) *Red River, below Fulton, Ark.*—This improvement was undertaken by the United States in 1828, and between 1828 and 1841 more than $425,000 was appropriated for removal of the great Red River raft. When work commenced the raft was 92 miles long, extending from Loggy Bayou, 65 miles below Shreveport, La., to Hurricane Bluffs, 27 miles above. A channel was opened through this obstruction, but owing to failure of appropriations between 1841 and 1852,

additional raft formed. In 1852 $100,000 was appropriated, and in 1857 the agent in charge reported the route opened but not completed, with recommendation for appropriations of $50,000 a year for completion and maintenance. The total amount expended from 1828 to 1857 was $529,831.90. The sum of $3,545.60 was carried to the surplus fund. Nothing further was done for fifteen years, and in that long interval the results of much of the former work were lost.

When work was resumed, in 1872, the river above Shreveport, La., was closed by a raft 32 miles long, which was growing constantly. Below Shreveport the enlargement of an outlet through Tones Bayou was depleting the main channel and threatening its closure to navigation. At Alexandria, La., the falls were impassable at low stages. Navigation was difficult and dangerous at all places and at all times. The channel shifted frequently, and at flood the river overflowed the entire raft region. Both above and below Shreveport the bed of the river was a mass of sunken logs and stumps. The banks were heavily timbered and each flood caused them to cave or slide.

The project entered upon in 1872 contemplated opening navigation through the raft and closing Tones Bayou outlet. Under the river and harbor act of 1878 the removal of wrecks, snags, and other obstructions below Shreveport was commenced, and the act of 1879 authorized the same kind of work above the raft to Fulton, Ark. Work was carried on under three distinct appropriations until 1882, when it was combined in a general appropriation for continuing the improvement from Fulton, Ark., to the Atchafalaya River, Louisiana, with a provision for work at Alexandria, La. The river and harbor acts of 1884 and 1890 contained provisions for closing Sale and Murphy outlet, Louisiana; the acts of 1888, 1892, and 1894 authorized expenditures for improvement of Cypress Bayou, Bayou Dorcheat, and Sulphur River, tributaries of Red River; the act of 1902 provided for improvement of the channel at Shreveport, La., and the act of 1905 contained a provision for further improvement of the channel at Alexandria, La.

The project was amplified in the river and harbor act of July 13, 1892, to include the systematic clearing of the banks to remove the source of drift and snags; continuing snagging operations and the removal of jams and raft; dredging tow-heads and shoals; constructing a substantial system of levees to fix the course of the river, either alone or by cooperating with riparian States; the closure of all outlets that deplete the river; the fixing of caving banks to confine the river to the selected channel, and the prevention of injuries to regimen by new cut-offs or outlets. The nature of the improvement requires that it be continued for many years, and no estimate for completion is given on this account.

The amount expended from 1872 to the close of the fiscal year ending June 30, 1909, including $5,560.37 derived from sales, was $1,833,983.33, with the following chief results:

The channel cleared through the great raft in 1872–73 opened to navigation 188 miles of river above Shreveport to Fulton. Subsequent work secured the complete removal of the raft, prevented formations of the same nature, increased the width of the river 100 feet or more, and there now flows in the course laid out for it in the old raft region a broad and deep river, safe for navigation at all but the lowest stages. The survey of 1908 showed that the bed of the

river in the old raft region above Shreveport had lowered in places as much as 25 feet. Incidentally the removal of the raft drained the fertile valley and reclaimed thousands of acres of productive lands. Tones Bayou outlet is closed by a heavy earthen dam, connected with the line of levee above and below it, and the main channel, for a time called "Little River," has widened and scoured until navigation of the stretch is uninterrupted at low stages. All of the chief outlets along the right bank above Tones Bayou to the Arkansas-Louisiana line, 89 miles, have been closed with dams by cooperation with the State of Louisiana and local levee districts. Work at Alexandria Falls rendered them navigable at all stages. The channel was deepened from 2½ to 5½ feet at the lower falls and to 6 feet at the upper falls, lengthening the period of navigation about two months. Persistent snagging operations, repeated from year to year, have kept the river open and enabled steamboats to make regular trips, the river from the Atchafalaya to Fulton ordinarily being open for boats of 3-foot draft at stages about a foot above zero of the Shreveport gauge. The maximum draft that can be carried at mean low water is 3 feet to Montgomery, La., 162.5 miles above the Atchafalaya; 2½ feet to Shreveport, 320.5 miles; and 2 feet to Fulton, Ark., 508.6 miles. The range between low and high water at the several gauge stations is as follows: Fulton, Ark., 35.65 feet; Shreveport, La., 41.2 feet; Alexandria, La., 45.5 feet; and Barbre landing, Louisiana (Head of Atchafalaya River), 52.72 feet. Much of the work performed necessarily has been in repetition from time to time, and the items of improvement and maintenance are so closely allied that the cost of each can not be given separately.

At present steamboats seldom run above Fulton, Ark., but at high stages the river is navigable in fact to Denison, Tex., 292 miles above Fulton and 800 miles above the Atchafalaya River.

During the fiscal year ending June 30, 1909, work for maintenance of the improvement was continued as follows: Operations of snag boats, supplemented by those of shore parties during the period of low water, extended over the river between the head of Atchafalaya River, Louisiana, and Fulton, Ark., and unusually heavy work was required on account of the extraordinary flood of 1908, which disturbed the regimen and deposited many snags in the river. In Bossier Parish, La., 9,051 linear feet of levee, containing 124,126 cubic yards of embankment, was built to prevent further breaches in the levee line at that locality, and 50,700 cubic yards of levee embankment were built in Lafayette County, Ark., to aid in closing the Spirit Lake outlet. A resurvey of the river was made from mouth of Sulphur River, Arkansas, to head of Cane River, Louisiana, 190.5 miles. Plans were under preparation for the construction of a hydraulic dredge, required for the relief of navigation at shoal places during low water.

To maintain what has been accomplished and to gradually secure a more stable improvement will require a continuance of work for many years. The estimated cost is $75,000 a year, or biennial appropriations of $150,000, exclusive of extraordinary demands for new plant that will arise from time to time.

Notwithstanding the facilities for quick transportation afforded by railways, the commerce of Red River until recent years has consisted of large shipments of cotton, cotton seed and its products, lumber,

staves, timber, etc., with heavy return freights of general merchandise and plantation supplies.

The commerce and navigation reported for eighteen years showed great variations, due to the changing crop conditions, occasional periods of extraordinary low water during the busy season, and other causes, ranging in quantity from 66,376 to 279,946 tons per annum, with estimated values of from $1,506,500 to $9,185,000. The average for the eighteen years was 123,244 tons, valued at $4,359,900. To this should be added the commerce from Ouachita River, entering Red River at the mouth of Black River, the average of which was 178,070 tons, valued at $6,229,560, making a total of 301,314 tons, valued at $10,589,460.

In 1908, however, there was a marked decline of navigation above the mouth of Black River and the commerce reported in that stretch only amounted to 36,288 tons, valued at $198,240.

The project has effected a reduction of freight rates on all commodities.

For more extended information respecting the work performed, reference is invited to the report and illustrations at page 1909 of the Report of the Chief of Engineers for 1893, and to the subsequent reports of the district officers. Maps of Tones Bayou, Bayou Pierre, etc., were published in the reports of 1882, page 1542, and 1885, page 1490. An index sketch of the basin of Red River and diagrams showing the limits of high and low water were published in the report of 1891, page 1956, and the report of 1892, page 1587. Maps of the river at Shreveport were published in the reports of 1887, page 2682, and 1893, page 1921. Map of the river at Alexandria was printed in House Document No. 462, Fifty-sixth Congress, first session.

References were given in the Annual Report of 1904 to reports of examinations and surveys, with page numbers at which they may be found. (See Report of the Chief of Engineers, 1904, pp. 385 and 386.) Report of an examination of Boyce Landing, Red River, Louisiana, made in 1907, was printed in House Document No. 219, Sixtieth Congress, first session.

The available funds will be applied to continuing the improvement and to maintenance.

The estimated amount that can be profitably expended in the fiscal year ending June 30, 1911, in addition to the balance unexpended July 1, 1909, will be applied to the operation of snag boats and further work on the existing approved project. This additional work is for maintenance and the extension of benefits.

July 1, 1908, balance unexpended	$197,193.60
Amount allotted from appropriation by river and harbor act approved March 3, 1909	65,000.00
Amount received from sales of property	143.40
Amount transferred from appropriation for relief of sufferers from cyclone in certain southern States	2,443.87
	264,780.87
June 30, 1909, amount expended during fiscal year for maintenance of improvement	78,203.83
July 1, 1909, balance unexpended	186,577.04
July 1, 1909, outstanding liabilities	3,819.30
July 1, 1909, balance available	182,757.74

Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	$75,000.00

(*b*) *Red River between Fulton, Ark., and Denison, Tex.*—This part of the river was originally navigable for small boats during high stages only. The river at low water is a stream from 100 to 200 feet wide in the bends, winding in a shifting channel between banks which are frequently several hundred yards apart. The low-water depth varies from 1.5 to about 4 feet. The banks are covered with trees constantly caving into the river and forming snags and drifts.

The original appropriation for work above Fulton was made August 5, 1886. The project contemplated improving only high and medium stage navigation by removing snags and drift. Previous to the existing project no work was provided for above the mouth of the Kiamichi River. The amount expended under previous projects is $33,500.

The river and harbor act of March 3, 1905, entered upon a project for the improvement of the river between Fulton, Ark., and Denison, Tex. The project contemplates the removal of drift and snags, clearing the banks of timber in danger of caving into the river, and closing chutes and cut-offs where necessary. No estimate of cost has been made.

At the close of the fiscal year June 30, 1909, $182,737.06 had been expended on this project, of which amount $10,189.66 was expended on survey of river between Fulton, Ark., and mouth of Washita River, Oklahoma.

During the year the snag boat *C. A. Culberson* and 3 quarter boats have been engaged in snagging operations. The 62 miles above Fulton over which the *C. A. Culberson* has worked shows an increasing depth. With the snags removed, the river seems to be cutting itself a deeper and more stable channel.

The survey of the river between Fulton, Ark., and the mouth of the Washita River, Oklahoma, which was commenced in March, 1908, was completed during the year, and report made to the Chief of Engineers.

Beyond the rafting of logs and timber there has been no commerce of any value on this section of the river.

When this section of Red River is opened to regular navigation a very material reduction in both local and through freight rates to points in north Texas and Oklahoma must necessarily result.

To secure a stable improvement will require a continuance of work for a number of years. The available funds and additional appropriation recommended will be applied to continuing the work now under way of removing obstructions and bank clearing.

For references to reports of examinations and surveys see Annual Report of the Chief of Engineers for 1906, page 433.

July 1, 1908, balance unexpended		$70,848.30
Amount allotted from appropriation by river and harbor act approved March 3, 1909		40,000.00
		110,848.30
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$48,797.71	
For survey	4,787.65	
		53,585.36

July 1, 1909, balance unexpended	$57,262.94
July 1, 1909, outstanding liabilities	2,282.76
July 1, 1909, balance available	54,980.18
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	100,000.00

KIAMICHI RIVER, OKLAHOMA.

Following is the report of the Board of Engineers on a recent survey, printed in House Document No. 212, Sixty-first Congress, second session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., November 1, 1909.

Respectfully returned to the Chief of Engineers, U. S. Army.

This examination covers a length of river of about 175 miles, of which only about 25 miles is navigable. The physical condition of the greater part of the upper 150 miles is such that it can be made navigable only by an extensive system of locks and dams, the cost of which would be out of reasonable proportion to probable benefits. The adjacent country is generally sparsely settled, the nine towns or villages likely to be affected by the improvement having a total population of about 4,500, and there are no manufacturing or commercial industries likely to create a commerce of any magnitude if the river were improved.

In view of the foregoing and other facts stated within, the Board concurs with the district officer and division engineer in the opinion that Kiamichi River up to a point opposite Talihina is not worthy of improvement by the General Government.

Interested parties were notified by the district officer of his unfavorable report and informed that they might submit statements or arguments to the Board bearing upon the necessity for the improvement, but no communications of this nature have been received.

ARANSAS PASS HARBOR, TEXAS.

Report on a recent survey is printed in House Document No. 639, Sixty-first Congress, second session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., January 24, 1910.

Respectfully returned to the Chief of Engineers, U. S. Army.

The district officer submits herein an estimate for such work as he deems necessary in extension of the present project for securing a channel 300 feet wide and 25 feet deep through Aransas Pass. The work involves an extension of both jetties, repairs to the north or Haupt jetty, removing the old Nelson and Mansfield jetties, and the wreck of the steamship *Mary*, and certain dredging which, with contingencies, engineering, etc., he estimates will cost $2,028,125. He believes a dredge will be required at least for a part of the time to maintain the channel, and he estimates this work with a government dredge will cost $60,000 annually.

Attention is invited to the remarks of the district officer on railroad freight rates on rock used in the construction of the jetties, from which it appears that the rates now in effect and which are deemed high may be increased, in which event the estimates submitted would be vitiated; also to his remarks bearing upon the admission of rock from Mexico free of duty.

The district officer recommends the adoption of the project above outlined, but in view of the fact that at present there are no wharves or terminals for the handling of freight from ocean vessels and that nothing has been done toward the establishment of a permanent port, he believes that for the present efforts should be confined to securing a channel 20 feet in depth, and he recommends this course as the first step toward the larger project for a 25-foot depth.

His estimate for the work proposed for the next two years, looking toward a channel 20 feet in depth, is as follows:

Repairs to north or Haupt jetty	$70,000
Removal of Nelson jetty	10,000
Removal of Mansfield jetty	50,000
Removal of wreck, steamship *Mary*	7,500
Dredging, fiscal year 1911	60,000
Maintenance, 1912	60,000
Contingencies	20,000
Total	277,500

He proposes to use on this work the United States dredge *Comstock* or a similar government dredge. The division engineer concurs in recommending the adoption of the 25-foot project and undertaking at once the work just referred to as proposed by the district officer.

The question of the advisability of providing a deep-water entrance through Aransas Pass has been considered and favorably recommended in previous reports, and work looking toward that end has been authorized by Congress. It is deemed unnecessary, therefore, to enter into this phase of the subject again, particularly as conditions appear to have remained unchanged, except that the tributary country is rapidly developing agriculturally.

Believing that further work than that already authorized is necessary to secure a suitable deep-water entrance and that the plan proposed by the district officer has been well considered and is in harmony with the work already undertaken, the Board recommends its adoption. In view of existing conditions, the Board agrees with the district officer that it is advisable to undertake the work tentatively, looking first toward securing a depth of 20 feet, and it therefore recommends for the present the work outlined by the district officer at an estimated cost of $277,500.

In compliance with the provisions of section 13 of the act of March 3, 1909, the Board reports that there are no questions of terminal facilities, water power, or other subjects so related to the project proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures made in the interests of navigation.

For the Board:

WM. T. ROSSELL,
Colonel, Corps of Engineers,
Senior Member of the Board.

There is no harbor on the Gulf coast between Galveston and Tampico, and the country to the south and west of Galveston has been developing at a very rapid rate during the past few years. Practically all of the country south of the Southern Pacific Railroad from El Paso through San Antonio to Galveston, including a large part of northern Mexico, is naturally contributary to a port at Aransas.

There are at the present time three lines of railroads touching the shores of the bay within a few miles of the pass, viz, San Antonio and Aransas Pass; St. Louis, Brownsville and Mexico; and Texas Mexican. Other railways are approaching from the north and will certainly make connection at this point if a deep-water port is provided.

GALVESTON CHANNEL, TEXAS.

This is the channel passing along the wharf front of the city and connecting the same with the jettied entrance channel.

Galveston channel inside the inner bar had originally a depth varying from 20 feet at Fort Point to 30 feet off Twentieth street, and again to 20 feet off Thirty-second street. The width of the channel between the 18-foot contours was about 600 feet. The inner bar had originally a 9-foot depth, but conditions gradually became better until the outer bar, with about 12-foot depth, became the controlling factor.

All vessels drawing over 12 feet had to complete their cargoes by lightering after crossing the bar.

Appropriations by the United States Government for the channel began in 1902, when $100,000 was appropriated for improving the channel in accordance with the report submitted in House Document No. 264, Fifty-sixth Congress, second session. The act of March 3, 1905, authorized the construction of a dredge, *Col. A. M. Miller*, at a cost not to exceed $125,000.

The act of March 2, 1907, modified the project by providing for the extension of the channel from Fifty-first street to Fifty-sixth street, at an estimated cost of $129,310. (See H. Doc. No. 768, 59th Cong., 2d sess.) The adopted project therefore contemplates the excavation of a channel 30 feet deep and 1,200 feet wide from the inner bar to Fifty-first street and the extension of said channel 700 feet wide from Fifty-first street to Fifty-sixth street.

The estimated cost of the project as modified is $1,714,310.

The U. S. dredge *Col. A. M. Miller* moved during the fiscal year 858,587 cubic yards of material in widening and maintaining the channel, of which 700,330 cubic yards was new work and 158,257 cubic yards was maintenance.

The project is 58 per cent completed, giving a channel approximately 1,325 feet wide opposite the proposed immigrant landing station just within the inner bar, 900 feet wide and 25 to 33 feet deep to a point opposite Twenty-ninth street, and 750 feet wide and 25 to 35 feet deep to the end of the present wharf frontage.

The total amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1909, for dredging and dike construction was $719,576.19, of which $55,827.84 was for maintenance of the improvement.

Vessels drawing 28½ feet can now come to the wharves at mean low tide.

The *Monomoy* left this port August 31, 1908, drawing 28 feet and 2 inches, the *Irada* on October 9, 1908, drawing 28 feet, and the *Rowanmore* on November 21, 1908, drawing 28 feet and 6 inches.

Variation of level of water surface is about 1 foot.

The foreign trade, as given by the customs office, for the port of Galveston for the calendar year 1908 amounted as follows: Foreign exports, valued at $202,152,984; foreign imports, valued at $5,516,822; total, $207,669,806.

Partial statistics for coastwise trade were furnished by the secretary of the Galveston Chamber of Commerce and other interested parties as 900,497 tons, valued at $218,388,000.

The following is a comparison of foreign export values credited to ports in the United States on the Gulf of Mexico in the government records for a period of six years:

Fiscal year.	Galveston.	New Orleans.	Mobile.	Pensacola.
1902–3	$103,145,623	$147,056,230	$12,618,443	$13,744,544
1903–4	144,920,127	148,006,606	16,826,671	15,891,884
1904–5	126,085,590	149,866,358	18,071,982	15,340,265
1905–6	166,240,813	149,901,013	21,712,544	18,440,122
1906–7	236,277,727	169,897,811	24,463,696	19,218,488
1907–8	161,020,933	159,357,584	27,979,831	20,832,649

The value of foreign exports credited to the port of Galveston for the fiscal year 1896–97 amounted to $59,334,343, and for the fiscal year 1906–7 to $236,277,727, or about four times the amount for 1896–97. The gain from 1902–3 to the end of 1906–7 amounted to 129 per cent. During the year 1907–8 there was a decrease in value of commerce handled through this port amounting to $34,124,743.

A sufficient depth and width of channel is a necessary supplement to the deep water between the jetties to enable the vessels to reach the wharves. The work of the past year has put the channel in better condition for service than ever before, but with the increasing length of the vessels now entering the harbor the necessity for the full width of channel between harbor lines (1,400 feet) is becoming very marked.

It is proposed to apply the balance available on June 30, 1909, to the extension of channel and dike to opposite Fifty-sixth street, and the additional appropriation recommended in operation of the United States dredge for widening the present channel and for maintenance.

July 1, 1908, balance unexpended		$60,543.89
Amount allotted from appropriation by river and harbor act approved March 3, 1909		200,000.00
Proceeds of sales of contract prints		.60
Proceeds of sales of condemned property		179.17
		260,723.66
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$27,743.42	
For maintenance of improvement	7,202.09	
		34,945.51
July 1, 1909, balance unexpended		225,778.15
July 1, 1909, outstanding liabilities		5,009.75
July 1, 1909, balance available		220,768.40
Amount (estimated) required for completion of existing project		825,137.84
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1909		200,000.00

Report on a recent survey of Galveston Harbor, Galveston Channel, Texas City Channel, and Port Bolivar Channel is printed in House Document No. 328, Sixty-first Congress, second session. A summary is printed herein under heading "Channel to Port Bolivar, Texas." Following is an extract from the report of the Board of Engineers:

GALVESTON CHANNEL.

It is the opinion of the Board that if the present project for this channel, which provides for a depth of 30 feet and a width to Fifty-first street of 1,200 feet between harbor lines with an increase to 1,400 feet, if possible within the approved project estimates, and 700 feet to Fifty-sixth street, is modified to provide for a width of 1,000 feet between Fifty-first and Fifty-seventh streets, it will adequately subserve the interests of commerce for many years to come. In the general scheme, however, provision is made for extending the Galveston channel to the railroad bridge when necessary. This extension should also be given a width of 1,000 feet. It is probable that the development of wharf and dock facilities between Fifty-sixth street and the bridge will not be accomplished for many years. It is believed, however, that in the comprehensive plan to be adopted auxiliary channels such as those laid down by the district

officer should be included, although the necessity for their construction is remote. As the auxiliary channel crossing the entrance to West Bay will be used only as a channel-way and not for dockage purposes, the Board is of opinion that the width of this channel need not exceed 500 feet, and it is also of opinion that the channel connecting West Bay with Texas City and the one southwest of Pelican flats connecting Galveston channel with Texas City channel need not exceed 1,000 feet in width.

The estimated cost of the work for the completion of the present project for a depth of 30 feet in Galveston channel, modified to provide a width of 1,000 feet to Fifty-sixth street, is $1,130,100. The estimate for the extension of this work to the bridge is $1,269,300, which should be appropriated as required by the development of the wharf frontage. Based on the estimates of the district officer for the 1,400-foot auxiliary channels, the estimates for the widths recommended by the Board for these channels are, in round numbers, $2,767,500 for the channel connecting Galveston channel with Texas City and $2,318,000 for connecting Galveston channel with Texas City channel southwest of Pelican flats.

GALVESTON HARBOR, TEXAS.

Galveston Harbor originally embraced an anchorage area of over 1,960 acres, of which 1,500 acres had a depth of more than 20 feet, 1,300 acres had a depth of more than 24 feet, and 460 acres had a depth of more than 30 feet.

The entrance was obstructed by two bars, known as the inner and outer. The natural depth on the inner bar was about 9 feet and on the outer bar about 12 feet. These shallow depths prevented all but the lightest-draft vessels from using the harbor and necessitated the lighterage of cargoes to the larger vessels anchored in the deep water beyond the outer bar.

Prior to 1874 the projects for improving the harbor related to dredging operations on a small scale.

The project for the permanent improvement by jetties was adopted in 1874 and modified in 1880 and 1886. Previous to 1886, $1,478,000 was expended, with an additional sum of $100,000 subscribed by the city of Galveston in 1883.

The 1886 project provided for a certain depth of 25 feet and a possible depth of 30 feet by constructing jetties to a height of 5 feet above mean low tide and extending them to the 30-foot contour in the Gulf and supplementing the action of the tidal scour by dredging. The estimated cost of this revised project was $7,000,000.

The expenditures under the above projects resulted in 1900 in a depth of 26 feet at mean low tide on the outer bar, an increase of 14 feet since work began, and a depth of 26 feet at mean low tide on the inner bar, an increase of 16 feet during the same period.

The south jetty extended 35,603 feet and the north jetty extended 25,907 feet. The amount expended on this project was $7,041,684.42, of which $97,687.85 was for maintenance of the improvement.

The hurricane of September 8, 1900, damaged the jetties to a considerable extent, and a Board of Engineer officers estimated the cost of repairing the same at $1,500,000. (Annual Report Chief of Engineers, 1901, p. 2018.) Appropriations under this estimate commenced June 13, 1902.

The act of March 2, 1907, appropriated $300,000 and authorized continuing contracts for prosecuting the work to the amount of $700,000 additional, all of which has since been appropriated. In

pursuance of the discretion vested in him by this act, the Secretary of War approved a project for expenditure of the funds appropriated and pledged in obtaining a depth of 30 feet by repairing the jetties, by jetty extension, and by dredging, including construction of a new dredge.

For more extended information see House Document No. 340, Fifty-ninth Congress, second session, and River and Harbor Committee Document No. 11, Fifty-ninth Congress, second session.

The new dredge *Galveston* commenced work November 24, 1908, and the jetty extension and repairs of the jetties have continued during the year and are about 92 per cent completed. Maintenance by dredging has been carried on by the U. S. dredges *Galveston* and *Comstock*.

From June 13, 1902, to June 30, 1909, $2,102,512.12 have been expended in accordance with modified project, including $507,901.26 for dredging, $372,256.10 for construction of new dredge *Galveston*, and $3,443.72 for survey authorized by act of May 27, 1908.

The old wharf of the state quarantine department of Texas, located in Galveston Bay, which had been abandoned and was in a wrecked condition, also the load of stone of an old jetty barge near the channel south of Fort Point, were removed.

The project depth of 30 feet has been completed.

The sundry civil act of May 27, 1908, provided for a survey of Galveston Harbor as a whole for a comprehensive plan for further improvement. Report was made in December, 1908.

It is proposed to apply the amount estimated as a profitable expenditure in the fiscal year ending June 30, 1911, for maintenance by the operation of the dredges.

The outer-bar channel, where dredging is done, weather permitting, had at the beginning of the fiscal year 27½ feet at mean low tide. The last survey in June, 1909, shows a channel depth of 30¼ feet, an increase of 2¾ feet during the past year. With the exception of one stretch of less than 1,000 feet, there is a fine navigable channel of 32½ feet from within the inner bar across the outer bar to deep water.

The inner bar has disappeared, leaving a ruling depth of 36 feet at mean low tide. This result has been accomplished by the Galveston channel current, aided by the *Comstock*, which worked on the inner bar when it was too rough for it to work outside.

Mean tide fluctations on outer bar, 2 feet; inner bar, 1.64 feet; Galveston channel, 1.12 feet. Including Galveston channel, 1,738 acres now have a depth of 24 feet and over, and 888 acres have a depth of 30 feet and over.

All the commerce for Galveston channel, Texas City channel, Port Bolivar channel, Galveston ship channel, and Buffalo Bayou, which comes in from the Gulf or passes out to the Gulf, whether coastwise or foreign passes through the jetty channel.

A Board of Engineer officers in its report of December 19, 1902, stated that a conservative estimate of the value to the country of the present improvement at Galveston is more than $10,000,000 per annum. This benefit is probably, at the present time, more than double that amount annually.

July 1, 1908, balance unexpended		$720,345.16
Amount allotted from appropriation by river and harbor act approved March 3, 1909		200,000.00
Amount appropriated by sundry civil act approved March 4, 1909		70,000.00
Proceeds of sales of charts of Galveston Bay		28.00
Proceeds of sales of contact prints		1.04
Proceeds of sales of old boilers of dredge *Comstock*		1,200.00
Proceeds of sales of condemned property		156.58
		991,730.78
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$314,065.24	
For construction of dredge	306,033.51	
For maintenance of improvements	101,675.77	
		721,774.52
July 1, 1909, balance unexpended		269,956.26
July 1, 1909, outstanding liabilities		59,321.33
July 1, 1909, balance available		210,634.93
July 1, 1909, amount covered by uncompleted contracts		52,003.32
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvements, in addition to the balance unexpended July 1, 1909		[a]250,000.00

CHANNEL FROM GALVESTON HARBOR TO TEXAS CITY, TEX.

The natural depth over the line of this channel was from 4 to 8 feet. During 1895 and 1896 a channel 16 feet deep was dredged by the Texas City Terminal Company at an expense of $146,000. At the time of the adoption of the present project this channel had shoaled to its natural depth.

The river and harbor act of March 3, 1899, provided for deepening the channel north of Pelican Island from Galveston Harbor to Texas City, Tex., to a depth of 25 feet and a width of 100 feet at the bottom at a cost not to exceed $250,000.

The full amount had been expended on the work under this appropriation up to the close of the fiscal year ending June 30, 1905, the Texas City Company paying the expenses of superintendence, inspection, etc. The channel was dredged 100 feet wide on the bottom and 25 feet deep from Texas City wharves to 25 feet of water in Galveston Harbor, a distance of 34,000 feet.

In addition to the amounts mentioned above, the Texas City Company, according to figures furnished by them, expended $148,906.98 in completing channel, $172,734.58 in digging turning basin and slip, and in 1906 removed 698,222 cubic yards at a cost of $16,028.61 in maintaining channel.

This channel was redredged by contract completed September 19, 1907, for a distance of 17,590 feet from the wharf at Texas City, 1,001,147 cubic yards being removed.

During the past fiscal year 273,284 cubic yards of material have been removed by United States dredges in maintaining the channel.

[a] Since the preparation of this report and estimate the Galveston jetties have been damaged by the storm of July 21, 1909. The local officer estimates that the additional sum of $100,000 will be required to make the necessary repairs.

The total amount expended by the United States to June 30, 1909, is $285,960.34, of which $35,960.34 was expended in maintaining the channel.

Variation of water surface is about 1¼ feet.

The ruling depth on May 17, 1909, was 12 feet, but owing to the softness of the silt, ships drawing 17 feet can pass through the channel.

The effect of the project on freight rates has been very beneficial during the past year owing to the establishment of a new line of steamers from New York to Texas City, thereby breaking up the rate agreement that had existed between the old lines between New York and Galveston.

The tonnage for the port of Texas City, Tex., for the calendar year 1908, as furnished by the Texas City Terminal Company, of Texas City, is as follows: Foreign exports and imports, 59,072 tons, valued at $3,403,960; coastwise domestic, 96,927 tons, valued at $18,201,566; total 155,999 tons, valued at $21,605,526.

It is proposed to expend the available balance and the additional appropriation recommended in maintaining the present channel.

July 1, 1908, balance unexpended	$34,480.51
Amount allotted from appropriation by river and harbor act approved March 3, 1909	50,000.00
Proceeds of sales of contact prints	.40
	84,480.91
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	10,440.65
July 1, 1909, balance unexpended	74,040.26
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, in addition to the balance unexpended July 1, 1909	50,000.00

For summary of report printed in House Document No. 328, Sixty-first Congress, second session, see report herein under heading "Channel to Port Bolivar, Texas."

Following is the letter of the Chief of Engineers, submitting a report on a recent survey of this channel, printed in House Document No. 402, Sixtieth Congress, first session:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 17, 1907.

SIR: I have the honor to submit herewith for transmission to Congress reports of June 8, 1907, by Maj. Edgar Jadwin, Corps of Engineers, and September 7, 1907, with map, by Capt. John C. Oakes, Corps of Engineers, upon preliminary examination with plan and estimate of cost of improvement, respectively, authorized by the river and harbor act approved March 2, 1907, of Texas City channel, Texas, with a view to obtaining a channel 200 feet wide and 26 feet deep.

Under authority of the river and harbor act of March 3, 1899, a channel 100 feet wide and 25 feet deep was dredged to Texas City. This channel shoaled subsequently, and the act of March 2, 1907, carried an appropriation of $60,000 for maintenance of the improvement. It appearing as a result of the examination that further information as to the expense involved in obtaining the increased channel dimensions now contemplated and of maintaining the project so increased, was essential to a final determination of the advisability of under taking the further improvement, the preparation of an estimate of the cost of such improvement was ordered as provided by law.

The report of September 7, 1907, by Captain Oakes contains various estimates for securing and maintaining increased dimensions in the Texas City channel by dredging, with and without the aid of restraining dikes. In concluding the report Captain Oakes expresses the opinion that the present commerce of Texas City does not warrant the expenditure necessary to widen, deepen, and maintain the channel beyond the dimensions provided for by the present project, and that the improvement of this channel should be taken up in connection with the broad plans for the improvement of Galveston Harbor as a whole. However, as certain dikes mentioned by him would give considerable relief and reduce the annual cost of maintenance, he recommends their construction at an estimated cost of $40,000.

In forwarding this report, September 9, 1907, the division engineer, Col. E. H. Ruffner, Corps of Engineers, recommends that a channel 200 feet wide and 26 feet deep be provided at a first cost, including dikes, of $231,000, with $50,000 annually for maintenance after completion.

The reports have been referred, as required by law, for consideration by the Board of Engineers for Rivers and Harbors, and attention is respectfully invited to the Board's final report of November 25, 1907, herewith. In view of the facts presented the Board, practically agreeing with the local officer, reaches the conclusion that it is not advisable at the present time for the United States to undertake the extension of the improvement of Texas City channel "with a view to obtaining a channel 200 feet wide and 26 feet deep;" that the construction of dikes, as proposed by the district officer, at an estimated cost of $40,000 is advisable, if an effort is to be made to preserve the existing channel; and that the consideration of further provision for the commerce of Texas City should be postponed until it is brought up in the future in connection with broad plans for the development of Galveston Harbor.

I concur in the views of the Board of Engineers for Rivers and Harbors.

Very respectfully,

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

HOUSTON SHIP CHANNEL, TEXAS.

The ship channel in Galveston Bay and Buffalo Bayou are two links in the waterway connecting Houston with deep water in Galveston Bay, the other links being the San Jacinto River and the Morgan Canal.

In their natural state these two waterways had a depth of from 4 to 8½ feet, of various widths. The earlier projects for their improvement, adopted in 1871, 1877, 1881, and 1892, provided for a channel 100 feet wide and 12 feet deep. Dredging was carried on for a number of years, furnishing a channel sufficient for the character of vessels then navigating these channels.

In 1892 the Government purchased the Morgan Cut and Canal, 5.43 miles long, for $92,316.85.

The amount expended on original projects prior to operations under existing projects was as follows:

Ship channel in Galveston Bay (including the purchase of Morgan Cut and Canal, $92,316.85)	$800,328.16
Buffalo Bayou, Texas	210,137.64
Total	1,010,465.80

The existing project, adopted in 1899 (p. 1515, Annual Report Chief of Engineers, 1898), as modified in 1905 (p. 1495 et seq., Annual Report Chief of Engineers, 1905), is as follows:

For completing channel to head of Long reach, including turning basin 600 feet in diameter, 25 feet deep, side slopes 1 on 2, division 1 (bay), 1 on 3 in divisions 2 and 3 (river), least radius 2,500 feet, 150 feet on bottom in division 1 (bay), 100 feet on bottom in divisions 2 and 3 (river)	$3,170,000

26,000 feet of dike revetment	$40,000
One hydraulic dredge	150,000
Engineering and contingencies (about 10 per cent)	340,000
Total	3,700,000
Amount available December 1, 1904	150,000
Balance required	3,550,000

The act of March 2, 1907, appropriated $200,000 and authorized continuing contracts for prosecuting the improvement in the sum of $200,000, all of which has been appropriated.

Of the $200,000 appropriated March 2, 1907, $50,000 was expended for the restoration of the channel from foot of Main street, Houston, to head of Long reach.

By contract and United States dredges 3,717,209 cubic yards of material have been removed from the different divisions during the past fiscal year, of which 2,725,496 cubic yards was for maintenance and 991,713 cubic yards for improvement. Snagging operations have been carried on in the upper stretches of the bayou.

During the fiscal year the channel in the open bay has filled in generally throughout its entire length to an amount of 1,812,000 cubic yards. The channel in the bayou has not filled appreciably during the fiscal year, due to absence of freshets. Since the beginning of 1905 a fill of 8,178,000 cubic yards has taken place.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1909, was $2,082,668.63, of which $228,852.10 was for maintenance.

The project is about 50 per cent completed.

The usual variation of level of water surface is, division 1 (bay division), lower bay, 1.3 feet; upper bay, 0.5 foot; and divisions 2 and 3 (river divisions), less than one-half foot. In times of flood rises of 12 or more feet occasionally occur in Buffalo Bayou.

The maximum draft that can be carried on June 30, 1909, at mean low tide is, from Bolivar channel to Red Fish, 10 feet; thence to Morgan Point, 14 feet; thence to head of Long reach, 16 feet; thence 8 feet to foot of Main street, Houston. The channel has been dredged throughout to a depth of 18½ feet, including the turning basin.

The effect of this project on freight rates is unknown and is indeterminate because of a railroad rate differential in favor of Houston, authorized by the railroad commission of the State of Texas.

The wharf master at Houston reports the tonnage carried on the bayou during the calendar year 1908 as 602,734, valued at $28,318,621.

It is proposed to expend the available funds and the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, toward completing work now under way, including easing bends to 2,500 feet radius, maintenance toward a more uniform depth, repair of pile and brush dike in upper bay, and snagging operations throughout the bayou.

If progress is to be made toward the completion of the project depth, 25 feet, throughout this channel, more liberal appropriations must be made for the work, as the cost of maintenance is increasing yearly as increased depth is obtained.

June 30, 1909, amount expended during fiscal year:		
For works of improvement	$154,185.52	
For maintenance of improvement	76,567.45	
		$230,752.97
July 1, 1909, balance unexpended		184,943.66
July 1, 1909, outstanding liabilities		23,434.04
July 1, 1909, balance available		161,509.62
July 1, 1909, amount covered by uncompleted contracts		17,707.61
Amount (estimated) required for completion of existing project		2,800,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1909		300,000.00

The House committee in its report says:

This improvement has heretofore been appropriated for under the title of "Galveston Bay ship channel and Buffalo Bayou," and is to provide a continuous deep waterway from the city of Houston to the Gulf of Mexico. The present project, which was adopted in 1899, contemplates securing a channel 25 feet in depth from deep water in Galveston Bay to the head of Long Beach just below Houston, including a turning basin at that point. This project has been about 50 per cent completed, the channel having been dredged throughout to a depth of 18½ feet, but on account of its tendency to fill, particularly in the open bay, the depths at present available are considerably less than this.

Of the amount estimated as necessary to complete the existing project the sum of $2,800,000 is yet to be appropriated, and it is obvious that unless the work is pushed more rapidly and larger appropriations are made its completion will be postponed indefinitely. The work is considered of much importance by the local public, and with a view to hastening its completion your committee has been advised that they have in contemplation a plan to share with the United States the cost of the further work required. It appears that under the laws of the State of Texas a community may organize into what is locally termed a "navigation district," and when so organized may submit to popular vote the question of raising funds for a public improvement of this kind.

A delegation from the commercial and business interests of the city of Houston has recently appeared before your committee and stated that it is intended to take the necessary steps under the aforesaid state law to organize a "navigation district" for the purpose of providing the sum of $1,250,000, which it is proposed to put at the disposal of the Government to be applied to the completion of this project if Congress shall provide an equal sum, it being assumed that the final cost will be lessened and the work wholly completed for $2,500,000 if placed under contract and prosecuted continuously and uninterruptedly.

Your committee considers this offer a commendable one, and if carried out it will undoubtedly testify to their faith in the waterway, and their confidence that it will prove useful as a highway for the important commerce which centers in that growing and progressive city. Inasmuch, however, as the matter is yet in an inchoate state, the organization having not yet been effected and the people concerned not having passed on the proposition, your committee feels that Congress should go no further at this time than to indicate its willingness to cooperate in the method proposed. It will be noted that the legislation recommended and incorporated in the bill, while fully indorsing the proposition by appropriating and pledging the entire amount that the United States is to furnish, makes such appropriation and authorization dependent upon the local interests carrying out their part of the agreement.

In other words, no money whatever is to be available for expenditure, and no contract whatever is to be entered into until the Secretary of War shall be satisfied that the local interests have made provision for furnishing the whole of said sum of $1,250,000 (being one-half of the amount now estimated as being necessary to complete), have actually placed to his credit in a federal depository to be designated by him the sum of $300,000 (a sum equal to that actually proposed to be appropriated in this bill), and have further satisfied him that the remainder will be so deposited from time to time as appropriations

may be made by Congress, and in amounts equal to those so appropriated. Furthermore, it is provided that any contract entered into by the Secretary of War in this regard shall be specifically for the completion of the project, and that not more than one-half of the consideration agreed upon shall be furnished and paid by the United States.

It is believed that these provisions amply safeguard the interests of the United States and are fair and equitable to the local interests. If adopted, they will permit of the rapid prosecution and early completion of the work, provided the local interests furnish their portion of the money as proposed; and if they fail to do so no liability or obligation will attach to the United States by reason of this legislation.

PASS CAVALLO-PORT LAVACA CHANNEL, TEXAS.

Report on a recent survey is printed in House Document No. 1082, Sixtieth Congress, second session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C. September 21, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

In the within report on a survey of "a channel from Pass Cavallo to Port Lavaca," the district officer recommends an expenditure of $45,000 in constructing a channel 80 feet wide and 8 feet deep, with an outlay of $10,000 per annum for maintenance. The division engineer states that the expense of the proposed channel seems to be greater than expected in the preliminary examination, and he believes that the prospective commerce does not justify the work at the present time.

The district officer also presents an estimate for a 7-foot channel amounting to $10,000, with a maintenance charge of probably about $2,500 per year. In the opinion of the Board this latter project appears more reasonably proportionate to the commercial importance of the locality. From a communication of September 12, 1908, from the district officer the Board learns that there has been recently established a steamboat line between Galveston and Corpus Christi and Rockport, and that a steamer 107 feet long, 24 feet beam, drawing loaded 6 feet, is now in operation. On its first trip this steamer carried 190 bales of cotton to Galveston, and on a later trip 250 bales. It appears that if either the 7 or 8 foot channel were provided this steamer would be able to call at Port Lavaca, and would undoubtedly do so.

The Board concurs with the division engineer that the expense of providing the 8-foot channel is not at present warranted, but in view of the fact that the 7-foot channel will afford reasonable facilities for present and immediately prospective commerce the Board recommends the adoption of the lesser project to provide a depth of 7 feet to Port Lavaca at an estimated cost of $10,000, with an annual expenditure for maintenance of approximately $2,500.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

Port Lavaca has a population of about 2,000 people and is the terminus of one branch of the San Antonio and Aransas Pass Railroad, connecting that town with Victoria, Tex., and thence with all other parts of the State. The St. Louisville and Brownsville Railroad passes within 14 miles of Port Lavaca, crossing the San Antonio and Aransas Pass Railroad at Placedo. The principal industry of Port Lavaca is the fish and oyster business.

The country surrounding Port Lavaca has up to a very recent date been a cattle country, but is now being rapidly divided up into small farms and within the last three years there has been a tremendous development in production, particularly in cotton and rice, in this vicinity. Perhaps no other part of the United States shows such a

percentage of increase of population and commerce during the last three years as the country on the shores of Matagorda Bay. Any assistance that can be given by the General Government, in providing means to market the increasing produce of this territory would, in my opinion, be worthy of the General Government.

The advantage to be obtained by cutting through the shoals and dredging an approach to Port Lavaca would be to enable that town to enlarge its fishing and oyster business, particularly by employing a fleet of schooners for Gulf fishing, and also to enable schooners drawing 8 feet of water to run from Port Lavaca to Galveston, or to Aransas Pass on the opening up to that port.

CHANNEL TO PORT BOLIVAR, TEX.

Report on a recent survey of Galveston Harbor, Galveston channel, Texas City channel, and Port Bolivar channel is printed in House Document No. 328, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 11, 1909.

SIR: I have the honor to submit herewith for transmission to Congress, report of December 30, 1908, with maps, by Capt. John C. Oakes, Corps of Engineers, on examination and survey of Galveston Bay and Harbor, Texas, authorized by the sundry civil act approved May 27, 1908, as follows:

"That the Secretary of War be, and he is hereby, authorized and directed to cause to be made an examination and survey of Galveston Harbor, as a whole, including Galveston Harbor, Galveston channel, Texas City channel, and Port Bolivar channel, in the State of Texas, for the purpose of establishing a broad, comprehensive, and systematic plan for the future extension, enlargement, and deepening of said harbor, so as to meet the growing needs of commerce, and to estimate the probable cost thereof; the cost of said examination and survey to be paid out of the foregoing appropriation."

Since the date of this report the 30-foot project for the entrance channel at Galveston has been completed by the construction of jetties and by dredging, work of securing and maintaining a 30-foot depth in Galveston channel up to Fifty-sixth street has been prosecuted, and also the work of maintaining a depth of 25 feet in the channels to Texas City and Port Bolivar.

As required by the act, Captain Oakes presents in his report "a broad, comprehensive, and systematic plan" for the further improvement of the harbor and bay with the ultimate object of securing a depth of 35 feet in the channels now under improvement and those that will be brought into use by the increasing demands of commerce for additional facilities. Attention is respectfully invited to the conclusions of the district officer as to the order and extent of this further improvement of the locality; also to the views of the division engineer, Lieut. Col. Lansing H. Beach, Corps of Engineers, in a separate report of January 23, 1909, also herewith.

These reports have been referred for consideration by the Board of Engineers for Rivers and Harbors, and an extended review of the local officer's report is given in the Board's report of March 15, 1909, also herewith.

It appears that the difference in the cost of the 30 and 35 foot projects as presented is $10,386,000. In the opinion of the Board the extent and character of the commerce of Galveston are not such as to render the use of vessels of exceptional draft an economical necessity. The Board is of the opinion, therefore, that the general scheme of development of the improvement of Galveston Bay and Harbor should be based on channel depths of 30 feet. The findings of the Board are summed up as follows:

"In conclusion, the Board recommends that the present projects be extended so as to include the following features:

Jetty extension: South jetty, 3,200 feet from jetty beacon	$2,000,000
Galveston channel: Widening from 700 feet to 1,000 feet from Fifty-first to Fifty-seventh streets	55,400
Texas City channel:	
North dike	1,432,000
Channel, 30 feet by 200 feet	410,000
Port Bolivar channel: Channel, 30 feet by 200 feet, with turning basin 1,000 feet square	91,080
Total	3,988,480

"In addition to the above, $1,074,724 will be required for the completion of Galveston channel under the existing project. The Board recognizes the possibility of further expenditures becoming necessary in the future for developments along the lines of the general plan, but believes that their necessity is remote; that estimates now submitted may not be applicable when such necessity arises, and that local developments in the meantime may require a change in the details of the general plan now outlined. For these reasons the Board is of opinion that further work than that provided for in this paragraph should not be decided upon at this time."

I concur in the views and recommendations of the Board, but any provision for the extension of the south jetty should be sufficiently flexible to permit such variation as may be found desirable and necessary during the progress of the work, for favorable results from combined dredging and jetty action may materially reduce the amount of extension required.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

Following is an extract from the Report of the Board of Engineers:

Channel to Port Bolivar.—Port Bolivar is increasing in importance as a point of shipment. It is the terminus of a railroad and large expenditures have been made in providing both rail and navigation facilities. Under a project adopted by the act of March 2, 1907, a channel 25 feet deep and 150 feet wide, with a turning basin 400 feet by 600 feet, has been dredged. A modern pier and slip are under construction by private or corporate interests, and although not yet completed, have been used during the past year for the shipment of merchandise valued at $1,993,350.

The district officer is of opinion that this channel should have a depth similar to that of the main harbor and channel of entrance, and he recommends that the project be enlarged so as to provide a channel 200 feet wide and 30 feet deep, with a turning basin 1,000 feet square and of the same depth, and he calls attention to the probable necessity of changing direction of the channel and of ultimately enlarging it to 500 feet by 35 feet and extending the turning basin when a general depth of 35 feet through the entrance and in the main harbor is provided.

Estimate.

Channel 200 feet by 30 feet, with turning basin 1,000 feet square	$91,080
Same, 500 feet wide	176,880
Deepening above to 35 feet	46,000
Total for 35-foot development	222,880

The following is an extract from the report of the engineer in charge of the survey:

Port Bolivar is on the extreme southwest portion of Bolivar Peninsula and across Bolivar Roads from Galveston Island. At the present time the town is extremely small and of no importance except as the terminus of the Gulf and Interstate Railway Company of Texas, which extends from Beaumont to Port Bolivar along the Gulf shore and connects at Beaumont with the Santa Fe System, Southern Pacific System, Kansas City Southern, and Frisco-Rock Island lines. This railroad was placed in operation in 1897 and was badly wrecked by the storm of 1900. At that time it had very little financial backing and was not rebuilt until 1904 and then only in the flimsiest fashion. Within the past two years it has, however, become associated with some strong com-

pany, it being rumored that the Gulf, Colorado and Santa Fe Railway Company owns or controls this road. At any rate, within the last year $500,000 has been expended in improving the right of way, and the road is now in condition to operate with safety and is already doing considerable business, which shows a great increase over that of previous years.

The distance from Beaumont to Port Bolivar is 71 miles, being just about half the distance from Beaumont to Galveston by any other road, the next shortest line being via the Southern Pacific, 140 miles. Up to the present time freight shipments by this road to Galveston have been transported by ferry across the harbor to the Galveston wharves in the original cars, it being impossible for ships to reach the wharf, as there was only 8 feet of water up to the terminal property.

In March, 1906, the district officer, Captain Jadwin, Corps of Engineers, submitted a report of a preliminary examination of Port Bolivar channel and recommended that a channel be excavated from deep water in Bolivar Roads to the harbor line in front of Port Bolivar, having a depth of 25 feet and a width on the bottom of 150 feet, with an increased width in front of the wharf. The river and harbor act of March 2, 1907, appropriated $50,000 for this purpose, since which time a channel has been excavated of the project width and depth from Bolivar Roads to the wharf, with a turning basin 400 by 600 feet in width and the same depth in front of the wharf and slip.

The Gulf and Interstate Railway Company has expended during the past year $250,000 in the construction of a modern pier of permanent construction and a slip at Port Bolivar. This pier is 1,200 feet long and 360 feet wide, with a slip practically of the same dimensions, which has been excavated at the expense of the company to a depth of 25 feet. Plans are under consideration for the construction of warehouse facilities on this new pier in accordance with the best methods in vogue in this locality at an estimated cost of $50,000. It is expected that the principal business will consist of exporting lumber originating in the longleaf yellow-pine district of east Texas and Louisiana, and in addition naval stores, cotton, cotton-seed products, and rice will be handled.

In this connection it may be stated that a Galveston cotton factor remarked in my presence that he had on a certain date this year directed 80,000 bales of cotton for shipment to New Orleans, La., because of the lack of facilities at Galveston Harbor for handling this cotton and that he had told the management of the Gulf and Interstate Railway Company that they could have all the cotton he could ship over the road as soon as they were ready for the business. Had they been ready the 80,000 bales above mentioned would have been shipped to Port Bolivar instead of to New Orleans, La.

Galveston has been growing in importance as a railroad center and as a seaport. The commerce consists principally of export cotton and grain. The value of the exports, as given by the district officer, shows an increase from about $7,000,000 in 1867 to over $160,000,000 in 1908. The value of both imports and exports in 1908 is $166,710,449. The growth of the port is indicated by the table showing the number of steamers clearing for different years and their tonnage. This table also indicates the increased navigation facilities made available and the tendency toward the use of larger vessels. In 1891 there were 177 steamers clearing, with a total tonnage of 250,138, an average tonnage of 1,413; in 1902 there were 307 vessels cleared, with a total tonnage of 839,370, an average of 2,734 tons, since which time there has been no material change in the average tonnage. A table in the report of the district officer, giving the deepest draft carried over the bar for various years, shows clearly the increased depth made available in the channel. In 1893 the deepest draft carried was 16 feet 1 inch; in 1898, 24 feet 5 inches; in 1901, 26 feet; in 1904, 26 feet 8 inches; in 1908, 28 feet 6 inches. During that period the gross tonnage of the largest vessel using this full draft increased from 2,563 tons to 9,456 tons. The foreign and coastwise merchandise tonnage is reported as having increased from 492,077 tons in 1890 to 2,174,299 tons in 1905. It is stated that there are no reliable statistics of the coastwise trade for the years 1906, 1907, and 1908. One steamship line, however, reports having carried 1,215,337 tons in 1907. The shipment of cotton has increased from 499,934 tons, with a value of $81,303,363, in 1902, to 607,277 tons, with a value of $138,253,413, in 1908. Grain exports increased from about 11,000,000 bushels in 1897 to 16,000,000 bushels in 1908. The statement is made by the district officer that in a little over ten years Galveston has grown from a port of little significance to a rank of second in value of exports, second in value of exports and imports, and first in exports of cotton and cotton-seed products among the ports of the United States.

HARBOR AT SABINE PASS, TEXAS.

Prior to improvement there were depths of 18 and 17 feet, respectively, over the two bars in Sabine Pass, opposite the town of Sabine and opposite Fort Point. These bars were about 200 feet long. Throughout the other portions of the pass the least mean depth was 25 feet.

Beyond the shore line at the entrance to the pass there existed a bar about 3½ miles wide between the interior and exterior 18-foot bottom curves, over which there was not more than 6 feet of water at mean low tide. Channels 12 and 15 feet deep were dredged through this outer bar during 1878 and 1880, under the project of 1873, at a cost of $325,000, but they soon refilled.

The project of 1882 provided for the construction of parallel jetties at the entrance of the pass, 1,800 feet apart and about 4 miles in length from shore line to deep water in the Gulf, and for dredging the channel between these jetties if necessary. This work was designed to provide a channel of practicable width and a depth of 25 feet at an estimated cost of $3,177,606.50.

Construction of the jetties began in 1883, and under successive appropriations has been carried on since that date.

The river and harbor act of 1896 authorized contracts for the completion of the project, limiting the cost to $1,050,000, all of which has been appropriated.

Under contract approved June 22, 1897, the east jetty was completed for a length of 21,818 feet, riprap work only was completed for a length of 682 feet, and foundation only for 2,600 feet. The west jetty had a length of 15,560 feet, of which 1,490 feet was only riprap work and 4,950 feet was foundation only. About 3,000 feet of previous work was capped.

Dredging in the channel was carried on, under contract, in 1897, 1898, and 1899, the depth being increased to 25 feet and the width to 100 feet. The channel was again dredged in 1900 and 1901, with an allotment of $8,000 from the emergency appropriation of June 6, 1900.

Under the act of March 3, 1899, $150,000 was appropriated for straightening, widening, and otherwise improving the harbor by the removal of oyster reefs and flats between the United States life-saving station and a point opposite the United States light-house. The work was completed April 18, 1903.

The act of June 13, 1902, appropriated $25,000 for widening and straightening the main ship channel and increasing its depth from a point 1,000 feet north of the life-saving station to the entrance of the Port Arthur Canal in accordance with report published in the Annual Report of the Chief of Engineers for 1901, page 1915. This work was completed February 27, 1903, and the channel depth was increased to 25 feet at mean low water for an average width of 400 feet.

The act of June 4, 1897, appropriated $100,000 for the construction of a dredge (the *Sabine*), which was completed January 14, 1901.

Since this date the dredge has worked in the channel between the jetties seventy-five months and eight days and removed a total of 3,233,335 cubic yards. The remainder of the time she was either absent undergoing repairs or was engaged in emergency work at South Pass, Mississippi River.

The creation of the channel contemplated by the project has been completed. The existing project is for maintenance of a channel depth of 25 feet to be accomplished by dredging and the restoration of the jetties to a height of about 4 feet above mean low tide at an estimated cost of $1,016,573.

The act of March 2, 1907, appropriated $160,000 for continuing improvement and for maintenance and authorized contracts for materials or work to the amount of $200,000, which has been appropriated and expended in repairing the east jetty for a distance of 13,800 feet, 113,893.31 tons of riprap stone being used for this repair work, the contract being completed December 19, 1908.

Allotment of $200,000 was made from the appropriation act of March 3, 1909, to continue this improvement, and for maintenance.

Operations during the year have consisted in repairing east jetty and dredging channel between the jetties.

At favorable stages of the tide vessels have gone out during the year drawing 25½ feet. The usual variation of the tide is 1½ feet. By continued work the dredge *Sabine* is able to maintain only a very narrow channel of about 24 feet depth, and additional work is badly needed toward building up the low portions of the jetties to a height of about 4 feet above mean low tide.

The amount expended to June 30, 1909, was $4,129,896.83, of which $825,000 was expended on previous projects. Of the amount expended on the present project it is estimated that $290,497.03 has been applied to maintenance of improvement.

The amount estimated as a profitable expenditure in the fiscal year ending June 30, 1911, namely $300,000, will be applied to continuing the work of raising and repairing jetties and dredging in the channel.

Comparative statement of shipments and receipts.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1897	87,632	38,746	.....
1898	288,400	150,768	.....
1899	326,982	88,582	.....
Calendar year—			
1899	326,494	.....	488
1900	217,489	.....	109,005
1901	150,087	.....	67,402
1902	689,688	539,601	.....
1903	1,315,248	625,560	.....
1904	1,792,371	477,123	.....
1905	1,779,954	.....	12,417
1906	1,904,389	124,435	.....
1907	1,848,159	.....	56,230
1908	1,802,307	.....	45,852

Of the tonnage moved during the calendar year 1908, 65 per cent passed through Sabine Pass on its way to or from the Port Arthur Canal.

It would appear that the result of the improvement at Sabine Pass had had a marked effect in decreasing the freight rate on shipments to the seaboard, as the state railway commission has given Sabine and Port Arthur a low rate, called a differential, of 7 cents per hun-

dred on first-class freight from Beaumont to Sabine or Port Arthur, applying on all freight from interior points in Texas to Sabine or Port Arthur. This was done merely to equalize the rate, or differential, from Houston to Galveston, and was done only when it was shown to the commission that Sabine and Port Arthur were deep-water exporting points. It amounts to this: That all freight from interior Texas points for export through Sabine or Port Arthur pays the regular tariff rates to Beaumont, plus but 7 cents first-class freight, to be then hauled to Sabine, though the regular tariff from Beaumont to Sabine is 20 cents.

On page 407, Annual Report of Chief of Engineers for 1906, reference is made to previous reports on examinations and surveys of Sabine Pass.

July 1, 1908, balance unexpended		$194,622.28
Amount appropriated by sundry civil act approved March 4, 1909		10,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909		200,000.00
Collected in suit United States *v.* Charles Clarke & Co		302.93
Received from sale of blueprints		3.50
		404,928.71
Reverted to Treasury		1,194.56
		403,734.15
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$177,424.62	
For maintenance of improvement	27,657.47	
		205,082.09
July 1, 1909, balance unexpended		198,652.06
July 1, 1909, outstanding liabilities		1,334.08
July 1, 1909, balance available		197,317.98
Amount (estimated) required for completion of existing project		[a]456,573.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		300,000.00

WEST GALVESTON BAY CHANNEL, TEXAS, AND MOUTHS OF ADJACENT STREAMS, INCLUDING TRINITY RIVER, ANAHUAC CHANNEL, CEDAR BAYOU, CHOCOLATE BAYOU, AND BASTROP BAYOU.

This project embraced the improvement of the following localities: West Galveston Bay, the Galveston and Brazos Canal, Double Bayou, mouth of Trinity River, Anahuac channel, East Bay Bayou, Turtle Bayou, Clear Creek, Dickinson Bayou, Chocolate Bayou, Bastrop Bayou, Oyster Creek, and the mouths of adjacent streams. (Annual Report Chief of Engineers, 1900, p. 2438, et seq.)

Prior to March 3, 1899, the improvement of West Galveston Bay channel, mouth of Trinity River, and Cedar Bayou had been inde-

[a] This amount is the difference between the original estimate and the sum of the subsequent appropriations which have been applied to the work contemplated by it. Owing to the fact that as favorable prices have not been obtained as were expected, the figures now given are probably not a correct estimate of the further amount that will be required to complete the project. This matter will receive consideration, with a view to reporting a revised estimate to Congress, in connection with an examination now being made of this locality or in the next annual report.

pendent. At that date they were consolidated with the other works, except Anahuac channel, which was added by act of March 3, 1905, and Chocolate and Bastrop bayous, which were added by the act of March 2, 1907. The Brazos River, between Velasco and Richmond, which was included in the improvement for a time, is now covered by a separate appropriation and has been transferred to the Dallas district. The estimated cost of the modified project is $248,646.34.

The object of this improvement, in part, is to obtain and maintain a navigable channel depth of from 4 to 6 feet across the bars at the mouths of the streams and bayous from deep water in the bay to deep water in the bayous.

The improvement is intended to develop a light-draft inland navigation which will afford cheap transportation by light-draft steamers and barges to the coast country of Texas.

As the West Galveston Bay channel and Galveston and Brazos River Canal have been included in the "Inland waterway on the coast of Texas," and appropriated for under that heading, allotments for these works under this appropriation have ceased.

About five-sixths of the project has been completed.

The effect of these improvements has been generally to decrease freight rates to all points reached by the channels improved.

It is proposed to apply the balance available and the appropriation recommended in dredging and snagging, for maintenance, and in opening up bayous emptying into the Galveston bays, in accordance with approved project.

More and larger boats, especially power boats with schooner hulls, have been built to utilize the improvement. Most of the points reached are settlements not on railroads, and the improvements are of great importance to their commercial life.

The amount expended on these improvements under present project to June 30, 1909, has been as follows:

Channel across Hanna reef	$697.08
Double Bayou	13,193.99
Anahuac channel	12,100.00
Mouth of Trinity River	8,636.18
Cedar Bayou	11,946.23
Clear Creek	10,497.16
Dickinson Bayou	12,105.45
Bastrop Bayou	9,920.22
Chocolate Bayou	6,542.04
Dredge *Gen. H. M. Robert*	67,992.51
Dredge *Capt. C. W. Howell*	15,000.00
Total	168,630.86

(*a*) *Channel across Hanna reef (East Bay Bayou).*—This is a channel across Hanna reef, connecting lower Galveson Bay, East Bay, and East Bay Bayou, and is on the the direct line of the inland waterway project. The natural depth was 2 feet at mean low tide.

Amount expended on work of existing project up to the close of the fiscal year ending June 30, 1909, $679.08.

During the year 5,773 cubic yards of material was removed, making a channel 6 feet deep, 40 feet wide on the bottom, and 955 feet long. Maximum draft that can be carried June 30, 1909, is about 4 feet at mean low tide.

Variation of water surface, about 1 foot.

It is estimated that 500 tons of vegetables comes out of East Bay Bayou via Moodys and Ladys passes, and that about 250 tons of general merchandise returns. There is also some fish and oysters carried through these passes, but the present shallow channel prevents any extensive business being carried on.

(*b*) *Double Bayou.*—The navigation of this bayou was obstructed by a bar which prevented boats drawing over 2 feet of water entering the bayou.

The amount expended on work of existing project up to the close of the fiscal year ending June 30, 1909, $13,193.99, of which $6,240.79 was applied to maintenance, exclusive of $2,711.40 deposited by private parties.

This expenditure resulted in the excavation and maintenance of a channel 6,450 feet long, 60 to 80 feet wide, and from 5 to 7 feet deep across the bar and into the bayou.

The maximum draft that can be carried June 30, 1909, at mean low water is 7 feet.

The variation of water surface is about one-half foot.

This bayou within a half mile of its mouth divides into east and west branches, the east branch being navigable for 12 miles and west branch for 8 miles from mouth, making a total of 19½ miles.

The commerce through this channel, as given by Burt H. Collins, for the calendar year 1908, amounted to more than 5,000 tons of produce, mainly rice and merchandise, valued at $269,000.

(*c*) *Anahuac channel.*—The original depth of this channel was about 3 feet.

Amount expended on work of existing project up to the close of the fiscal year ending June 30, 1909, $12,100, of which $6,124.99 was for maintenance of channel.

The expenditure resulted in the excavation and maintenance of a channel 16,013 feet long, 80 feet wide, and 7 feet deep from 6 feet of water in Trinity Bay to 8 feet of water in Browns Pass.

Maximum draft that can be carried June 30, 1909, at mean low tide is 4½ feet.

Variation of water surface is about one-half foot.

This channel is used by United States mail boat, and as there is no railroad communication with the adjacent country all produce and supplies pass through this channel. Rice is the principal agricultural product.

This channel is navigable for 3¼ miles from the 6-foot contour in Galveston Bay to Anahuac.

Commercial statistics received show the commerce to be more than 15,000 tons, valued at $780,000.

(*d*) *Mouth of Trinity River.*—This river empties into Galveston Bay through several mouths or passes, opposite each of which a bar existed on which the depth of water did not exceed 3½ feet at mean low tide.

Under earlier projects, adopted June 18, 1875, and amended May 4, 1899, dredging and snagging were done, the west jetty at Middle Pass completed to a length of 7,359 feet, and a channel 100 feet wide by 5 feet deep secured at a cost of $75,900. The channel subsequently shoaled to a ruling depth of 3½ feet, and at present Browns Pass leading to the Anahuac channel is the one used and under improvement.

Amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1909, $8,636.18, of which $4,995.74 was applied to maintenance.

Under present project a channel 80 feet wied and 6 feet deep was dredged a distance of 5,700 feet and a log jam removed from the pass.

Maximum draft that can be carried June 30, 1909, at mean low water, 4½ feet.

Variation of water surface is about one-half foot.

During the calendar year 1908, lumber, rice, etc., valued at $599,430, passed through this channel in addition to miscellaneous supplies.

(*e*) *Cedar Bayou.*—Cedar Bayou discharges into the northwest corner of Galveston upper bay at a point about 1½ miles below the mouth of the San Jacinto River, and distant 28½ miles from Galveston.

The original project for this improvement was adopted September 19, 1890, and consisted in deepening the channel over the bar by dredging, so as to afford a depth of 5 feet at mean low tide, and protecting the dredged channel by brush and stone walls or jetties. The amount previously expended on this project was $32,150.

After crossing the bar a least depth of 9 feet can be carried up the bayou for a distance of 17 miles.

Under present project the jetties were repaired by filling the lowest places and gaps with riprap, and a channel 8 feet deep, 80 feet wide, 8,690 feet long was dredged from the 8-foot depth inside the bayou across Cloppers bar and connecting with the 8-foot depth in San Jacinto Bay.

During the fiscal year 9,375 cubic yards of material was removed in maintaining the channel.

Amount expended on existing project to close of fiscal year ending June 30, 1909, $11,946.23, of which $5,009.08 was applied to maintenance.

Maximum draft that can be carried June 30, 1909, 6 feet. This stream is navigable to Needle Point, head of navigation, a distance of 20 miles from the mouth.

The rise and fall of tide is about one-half foot, except during freshets.

It has been impossible to obtain the commercial statistics of the effect of this improvement. One boatman reports taking out 24,000 tons brick, valued at $120,000, and 18,000 tons sand, valued at $18,000, during the calendar year 1908. Rice and other agricultural products, together with supplies for the adjacent community, are carried through this channel, there being no railroad facilities within convenient distance.

(*f*) *Clear Creek.*—Clear Creek empties into Galveston upper bay from the west. It was obstructed at its mouth by a narrow sand bar, on which the depth did not exceed 2 feet. For a distance of 2 miles above the mouth the ruling depth is 8 feet. It then broadens into a lake 3 miles long and 1½ miles wide, having, before improvement, an average depth of 1½ feet. Above the lake the prevailing depth is from 8 to 12 feet.

Private parties have at various times dredged through the bar at the mouth into Galveston Bay, and during 1907–8 the U. S. dredge

Captain C. W. Howell dredged a channel 22,847 feet long, 40 feet wide, and from 4 to 6 feet deep. At present there is across this bar a channel about 40 feet wide with a least depth of 4 feet at mean low tide.

Amount expended on existing project to close of fiscal year ending June 30, 1909, $10,497.16, of which $7 was applied to maintenance.

The maximum draft that can be carried June 30, 1909, at mean low tide over the shoalest part of the locality is 4 feet.

After crossing the bar a least depth of 9 feet can be carried up the bayou for a distance of 17 miles.

This stream is navigable to Friendswood, at the head of navigation, a distance of 20 miles, except that same is obstructed 10 miles from its mouth by Galveston County road bridge and Galveston, Houston and Henderson Railway bridge and 14 miles from its mouth by Davis bridge. During the past year the bridges have been modified so as to provide a 24-foot opening.

Variation of water surface is three-fourths foot.

No commercial statistics have been obtained.

(*g*) *Dickinson Bayou.*—Dickinson Bayou empties into Galveston lower bay about 20 miles northwest of the city of Galveston. Navigation was obstructed by a bar at its mouth with 2½ feet of water on its crest. After crossing the bar a depth of 10 feet can be carried up the bayou for 20 miles or more, and a depth of 6 feet for a distance of 25 miles from its mouth.

During the past year the U. S. dredge *Captain C. W. Howell* excavated a channel from 6 to 6½ feet deep and about 60 feet wide over a distance of 19,100 feet through the shoal water of the bay and to deep water in the bayou.

Amount expended on existing project to close of fiscal year ending June 30, 1909, $12,105.45, of which $5,823.12 was applied to maintenance.

The maximum draft that can be carried June 30, 1909, at mean low tide over the bar is 5 feet.

This stream is navigable 10 miles from mouth to Galveston, Houston and Henderson Railway bridge for tugs and schooners. The same class of vessels could navigate to a point 25 miles from the mouth on removal of county and railway bridges.

Variation of water surface is 1 foot.

Partial information received shows the commerce passing through this channel to be more than 1,400 tons, valued at $28,600.

(*h*) *Bastrop Bayou.*—Bastrop Bayou empties into Bastrop Bay, which is part of West Galveston Bay. The mouth of the bayou is 5 miles northwest of San Luis Pass and had a long shallow approach with only 10 inches of water on the bar. For 2 miles above the bar the water is shallow, averaging about 2 feet. Above that point there is, in general, a depth of 10 feet, but this depth was reduced by three shoals of a total length of about 3 miles with a depth of 2 feet. The stream can be navigated for a distance of 20 miles from its mouth.

A channel 400 feet long, 35 to 40 feet wide, and 4 feet deep was cut through the shell reef at the entrance to Bastrop Bay by the U. S. dredge and snag boat *Gen. S. M. Mansfield* in 1906, at a cost of $262.42, this amount being subscribed by interested parties.

During 1907 the U. S. dredge *Captain C. W. Howell* cut a channel 18,765 feet long, 40 feet wide, and 4 to 5 feet deep up the bayou beyond three small shoals obstructing navigation.

Amount expended on work of existing project to close of fiscal year ending June 30, 1909, $9,920.22.

The maximum draft that can be carried June 30, 1909, at mean low tide over the shoalest part of the locality is 3 feet.

Variation of water surface, 1 foot.

No commercial statistics have been obtained.

(*i*) *Chocolate Bayou.*—Chocolate Bayou empties into Chocolate Bay, an arm of West Galveston Bay, about 12 miles north of San Luis Pass. At its mouth there is a bar with 3 feet of water on its crest. Above this bar the depth varies from 7 to 15 feet for 50 miles from its mouth.

During the fiscal year the U. S. dredge *Captain C. W. Howell* removed 98,904 cubic yards of material, making a channel 5½ feet deep, 40 feet wide, and 21,000 feet long from 5 feet of water in West Galveston Bay through Chocolate Bay to 5 feet of water in Chocolate Bayou.

Amount expended on work of existing project to close of fiscal year ending June 30, 1909, $6,542.04, of which $29.82 was applied to maintenance.

The maximum draft that can be carried June 30, 1909, at mean low tide over the shoalest part of the locality is 5 feet.

Variation of water surface, 1 foot.

This channel is used regularly by light-draft vessels a distance of 24 miles from its mouth to Liverpool. It is also navigable for 15 miles beyond Liverpool, and navigation could be extended farther were it not for the overhanging timber along the banks.

No commercial statistics have been obtained.

CONSOLIDATED.

July 1, 1909, balance unexpended		$7,950.28
Amount allotted from appropriation by river and harbor act approved March 3, 1909		50,000.00
Proceeds of sales of condemned property		89.46
		58,039.74
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$6,196.34	
For maintenance of improvement	23,565.49	
		29,761.83
July 1, 1909, balance unexpended		28,277.91
July 1, 1909, outstanding liabilities		5,999.29
July 1, 1909, balance available		22,278.62
Amount (estimated) required for completion of existing project		59,646.34
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1909		110,000.00

BRAZOS RIVER, TEXAS, FROM VELASCO TO OLD WASHINGTON.

This section of the river has a width of from 200 to 400 feet. It has good depth from the mouth to near the head of tide water above Columbia (mile 36). It is navigable for light-draft boats throughout its length for about eight months in the year.

The original project for this improvement was adopted June 3, 1896, and contemplated the removal of snags and overhanging trees and dredging troublesome shoals between Velasco and Richmond only. The sum of $5,000 was expended on this project.

In the river and harbor act of June 13, 1902, the improvement from Richmond to Old Washington was undertaken. In the act of March 3, 1905, this improvement was continued from Velasco to Old Washington. The project on which these appropriations were based (see Report of the Chief of Engineers, 1901, p. 1974) contemplated the improvement of the river by open-channel work between the mouth and Old Washington, at a cost of $225,000.

Amount expended on work of existing project up to June 30, 1909, was $216,864.51.

The operations during the year consisted in constructing and repairing jetties, removing obstructions by snagging, and repairing plant. Below mile 110 (or 10 miles above Richmond) a depth of 4 feet for approximately eight months in the year has been obtained between Velasco and Richmond. The project in this part of the river is about 90 per cent completed. From Richmond to Old Washington no work of any consequence has been done during the year, the project being about 50 per cent completed. Over this section a depth of 4 feet is available for navigation by boats having considerable power during rises of from 1 to 2 feet. No commerce of any note has developed, nor can any be expected until the Brazos River is improved from its mouth up to Waco, or until the territory about the lower portion is given over more to agriculture than it is now.

The distances of the various places mentioned in the above report from the mouth of the river are as follows: Velasco, 5 miles; Columbia, 35 miles; Richmond, 99 miles; Rosenberg, 108 miles; Old Washington, 254 miles; Navasota Lock, 259 miles; Waco, 424 miles.

The improvement has so far caused no effect on freight rates.

The available balance, as well as the $55,000 requested for the fiscal year ending June 30, 1911, will be used to build the new snag boat *Waco* and in keeping plant in operation on open-channel work.

For reference to reports of examinations and surveys, see Annual Report of the Chief of Engineers for 1907, page 453.

July 1, 1908, balance unexpended		$54,326.78
Amount transferred from Galveston district account of repairs to dredge		15,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909		25,000.00
Received from sales		18.00
		94,344.78
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$16,328.96	
For maintenance of improvement	4,862.33	
		21,191.29
July 1, 1909, balance unexpended		73,153.49
July 1, 1909, outstanding liabilities		3,079.43
July 1, 1909, balance available		70,074.06
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		55,000.00

BRAZOS RIVER, TEXAS, FROM OLD WASHINGTON TO WACO.

The profile of this section of river shows an alternating series of steep and gentle slopes, not navigable, above Hidalgo Falls.

In the river and harbor act of March 3, 1905, an examination of this section was ordered and a provisional appropriation for its improvement was made. In the act of March 2, 1907, a further appropriation was made, in accordance with a project submitted in a report published in House Document No. 705, Fifty-ninth Congress, first session. This project contemplates securing a navigable depth of 4 feet for four months and 3½ feet for six months of the year by constructing eight locks and dams and 103 miles of open-channel work, at a total cost of $2,915,000. It is not clear to what extent the project outlined therein may be regarded as adopted by Congress in appropriating for the work, and thus far it has been assumed that the Government is committed to the construction of only one lock and dam at an estimated cost of $300,000.

The river and harbor act of March 2, 1907, authorized continuing contracts in the sum of $150,000, in addition to amounts already appropriated for the completion of the lock and dam at Hidalgo Falls, which amount has been appropriated.

From the amount of money appropriated by river and harbor act of March 3, 1909, the sum of $75,000 was allotted. This allotment was required in addition to the $300,000 to repair flood damages and to construct bank protection to prevent further erosion at site of the lock.

On June 30, 1909, $233,830.04 had been expended on the construction of lock and dam at Hildalgo Falls.

During the fiscal year $85,244.40 has been expended in completing the construction, by hired labor, of the lock, with the exception of lock gates, controlling valves, maneuvering devices, and also in the placing of bank protection and repairing flood damages.

No work on the project has been done except the building of the lock and dam at the foot of Hidalgo Falls, which work is about 55 per cent completed, so that no change has been made in this stretch of the river.

Should this portion of the river, as well as that below Old Washington, be properly improved, there is no doubt that the improvement would cause a great reduction in freight rates throughout the contiguous country.

If it is the intention of Congress to continue the improvement by the construction of additional locks and dams, money should be provided in sufficient amount to enable the improvement to be carried on more rapidly than it has been in the past.

July 1, 1908, balance unexpended	$101,414.36
Amount appropriated by sundry civil act approved March 4, 1909	50,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	75,000.00
Received from sale of blueprints	7.75
	226,422.11
June 30, 1909, amount expended during fiscal year, for works of improvement	85,244.40

July 1, 1909, balance unexpended	$141,177.71
July 1, 1909, outstanding liabilities	6,255.81
July 1, 1909, balance available	134,921.90

TRINITY RIVER, TEXAS.

The river in its upper reaches is a narrow stream with a low-water depth insufficient for even light-draft navigation. Its banks are generally high and quite stable, making it particularly susceptible to improvement by canalization.

The river and harbor act of June 13, 1902, adopted a project for the improvement of this stream in accordance with a report submitted in House Document No. 409, Fifty-sixth Congress, first session. (See Annual Report of the Chief of Engineers for 1900, p. 2348.) This project contemplated improvement to provide a 6-foot navigation from Dallas to the mouth, a distance of 511 miles, by open-channel work and a system of locks and dams.

The original estimate of cost of this improvement was $4,550,000. The portion of this applicable to section 1 ($350,000) was afterwards raised to $918,000 in a report from a board of engineers appointed to examine into the cost. (See Annual Report of the Chief of Engineers for 1904, p. 2021.)

The amount expended on this improvement up to June 30, 1909, was $430,541.40.

Four locks and dams in section 1 have already been provided for by Congress. The money for Nos. 1, 2, and 6 has already been appropriated, and funds have been appropriated and authorized for No. 4 and for a lock and dam at Hurricane shoals, which is in section 2, and of the authorization $85,000 is yet to be appropriated.

During the year, Lock and Dam No. 1 was practically completed, and during March, 1909, the contractor moved his force to the mouth of Parsons Slough and commenced work on the dam at this place. The construction of these two dams is covered by one contract. About 65 per cent of work on dam at Parsons Slough has been completed.

The contractor who has the contracts for the construction of Locks and Dams Nos. 2 and 4 has done very little work during the year, except remodeling plant, excavating, and placing cofferdam.

Work on Lock and Dam No. 6 has progressed more favorably this year, and about 60 per cent of the contract has been completed.

For the reasons given in the local officer's report it has been found necessary to increase the estimate for Lock and Dam No. 4, in section 1, and at Hurricane shoals, in section 2. He states that approximately $85,000 will be needed in addition to the $85,000 now covered by continuing-contract authorization and not yet appropriated, making the total further amount that will be required to be appropriated to complete these works $170,000, and that this additional $85,000 should be provided for by cash appropriation or contract authorization.

Lock No. 1 is at McComas Bluff, 13 miles below Dallas; the dam at Parsons Slough is 22 miles below Dallas; and Locks Nos. 2, 4, and 6 are 23, 30, and 42 miles, respectively, below Dallas.

Snagging operations were continued on the lower river.

The expenditures made in cleaning the river have resulted in no increased depth, but the removal of snags and drifts has made the stream safer to navigate at medium and high stages. There is no navigation of account above Liberty other than the rafting of logs.

Owing to the fact that the river is not yet navigable to Dallas, the only place at which it can come into active competition with the railroads, no effect on freight rates has been produced. Inasmuch as the leading trunk lines of this section are crossed by the river at Dallas, there can be no doubt that when the river is made navigable to this point it will result in a considerable reduction and an immense saving, not only in local, but also in interstate freight rates in this section.

For references to reports of examinations and surveys see Annual Report of the Chief of Engineers for 1906, page 431.

If it be decided to prosecute this project further, provision should be made in the shape of increased appropriations.

July 1, 1908, balance unexpended		$488,877.64
Amount appropriated by sundry civil act approved March 4, 1909		125,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909		75,000.00
Received from sale of blueprints		11.00
		688,888.64
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$107,026.86	
For maintenance of improvement	12,996.14	
		120,023.00
July 1, 1909, balance unexpended		568,865.64
July 1, 1909, outstanding liabilities		2,921.76
July 1, 1909, balance available		565,943.88
July 1, 1909, amount covered by uncompleted contracts		367,712.31
Amount (estimated) required for completion of existing project		[a] 170,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		[b] 183,000.00

INLAND WATERWAY ON THE COAST OF TEXAS.

The river and harbor act of March 2, 1907, appropriated $133,829, and authorized the Secretary of War to enter into contract for materials and work to the extent of $300,000, all of which has since been appropriated.

This project embraces the improvement of the following localities: West Galveston Bay and Brazos River Canal; channel from Aransas Pass to Pass Cavallo, including the Guadalupe River to Victoria; Turtle Cove channel from Aransas Pass to Corpus Christi, Tex.

The object of the improvement is to obtain and maintain a navigable channel depth of 5 feet in a canal along the coast of Texas, utilizing the lagoons lying between the islands and the mainland. The improvement will develop a light-draft inland navigation which

[a] This estimate pertains only to the locks and dams, the construction of which has been specifically authorized by Congress.

[b] Of this amount $85,000 is for continuing contract work authorized by the river and harbor act of March 2, 1907, and $98,000 for open-channel work.

will afford cheap transportation by light-draft steamers and barges to the coast country of Texas.

More and larger boats with auxiliary gas engines have been built to utilize the improvement. Most of the points to be reached are settlements which railways can not afford to develop, but the improvements are of great importance to their commercial life.

The project is about 70 per cent completed.

No reduction of freight rates due to this improvement has been noticed.

Amount expended under this appropriation to June 30, 1909, has been as follows:

West Galveston Bay and Brazos River Canal	$124,383.29
Aransas Pass to Pass Cavallo	45,362.81
Guadalupe River	68,258.60
Turtle Cove channel	122,107.64
Total	360,112.34

It is proposed to apply the balance available and amount estimated as a profitable expenditure in dredging, snagging, etc., in accordance with approved project.

(*a*) *West Galveston Bay and Brazos River Canal.*—Previous to 1908 these channels were carried under another appropriation—viz, "West Galveston Bay channel, Texas, and mouths of adjacent streams, etc."

West Galveston Bay.—This is a body of water covering about 39 square miles and lies between Galveston Island and the mainland. It extends from Galveston Bay to the west end of Oyster Bay and is connected with the Gulf of Mexico by San Luis Pass at the western extremity of Galveston Island and with the Brazos River by the Galveston and Brazos Canal. The minimum depth of the bay was from 2½ to 3 feet.

The project adopted July 13, 1892, and modified in 1896, contemplated a least depth of 5 feet, at an estimated cost of $28,998.80.

The work done resulted in a channel 100 feet wide and 3 to 3½ feet deep from Galveston Bay to the Galveston and Brazos River Canal. Beacons were also erected to define the channel. The channel subsequently shoaled to 18 inches in places.

Amount expended, including maintenance, to close of the fiscal year ending June 30, 1907, $35,059.69.

The maximum draft that can be carried at mean low tide June 30, 1909, is 3 feet.

For report of examination upon which new project is based see House Document No. 640, Fifty-ninth Congress, second session.

From records kept by the Gulf, Colorado and Santa Fe Railway Company of vessels passing through the draw of its bridge across West Galveston Bay during the calendar year 1908, 5,054 vessels used the waters of West Galveston Bay.

The U. S. dredge *Gen. H. M. Robert* was engaged during the year in deepening and straightening channel. Up to April 17, 1909, a channel 8 feet deep, 80 feet wide on bottom, was dredged for a distance of 8,800 feet, at which time the dredge was destroyed by fire. A channel was also cut under drawbridge and old piling removed.

Galveston and Brazos River Canal.—This canal was originally dredged by the Galveston and Brazos Navigation Company. The

original cut was 10 miles long (made in 1851–1853), 100 feet wide at bottom and 6 feet deep. Steamboats from 145 to 175 feet long and from 28 to 30 feet wide used the canal, carrying from 550 to 1,200 bales of cotton.

The United States purchased the canal in December, 1902, at a cost of $30,000. The canal when acquired by the United States was badly obstructed with snags, drift, and silt.

Previous to June 30, 1907, the canal had been dredged for practically its entire length to a depth of 3 feet at mean low tide and width of from 35 to 40 feet. The bank had been reenforced at various points by brush.

The length of the canal from west end of Oyster Bay to Brazos River is 8¾ miles; ruling depth, 3 feet. The canal connects with West Galveston Bay by a dredged channel across Oyster and Bastrop bays and a new cut across Mud Island, shortening the old route 3½ miles.

Amount expended, including maintenance, on the canal up to the close of the fiscal year ending June 30, 1907, was $67,307.66, of which $30,000 was for purchase of canal and $3,203.97 applied to maintenance.

The existing project, combining this channel and West Galveston Bay channel under one appropriation, was adopted by the river and harbor act of March 2, 1907, and provides for a channel 40 feet wide and 5 feet deep, at an estimated cost of $151,529 and $20,000 annually for maintenance.

The U. S. dredge *Captain C. W. Howell* has been engaged during the year in deepening the channel to 5 feet, with 1 foot over depth, 60 feet wide, for a distance of 36,910 feet.

A pile-and-brush dike was built across Oyster Creek, where it had cut through south bank of canal. A new boom was constructed at the entrance to the canal into the Brazos River.

The canal is practically completed.

The combined project is about 70 per cent completed.

Amount expended on existing project to close of fiscal year ending June 30, 1909, $124,383.29, of which $20,000 was for maintenance of the improvement.

The total amount expended on the West Galveston Bay and Brazos River Canal project to June 30, 1909, is $226,750.64, of which $30,000 was for the purchase of the canal and $24,589.31 for maintenance.

The maximum draft that can be carried June 30, 1909, at mean low tide over the shoalest part of the channel, which is in West Galveston Bay, is 3 feet.

Variation of water surface is about 1 foot, except at time of Brazos River overflow and northers.

No commercial statistics have been obtained.

Amount (estimated) required for completion of existing project____ $20,000.00

(*b*) *Channel from Aransas Pass to Pass Cavallo.*—This channel was originally developed by the State of Texas and private parties and was the old United States mail route between Indianola and Corpus Christi. In 1875 vessels drawing not over 3 feet could navigate the channel.

The project, as adopted by act of March 2, 1907, contemplates a depth of 5 feet, 40 feet wide, from the entrance at Aransas Pass to Matagorda Bay, a distance of about 63 miles, at a cost of $68,850.

The contract for dredging this channel was continued during the year and is now about 90 per cent completed.

Amount expended on existing project to close of fiscal year ending June 30, 1909, $45,362.81.

The maximum draft that can be carried at mean low tide over the shoalest part of the proposed route is 4 feet.

Variation of water surface, about three-fourths of a foot.

No commercial statistics have been received.

Report of examination is printed in House Document No. 640, Fifty-ninth Congress, second session.

(*c*) *Guadalupe River, bay section.*—This channel connects the mouth of the Guadalupe River with the channel from Aransas Pass to Pass Cavallo. For the first 8 miles there was 6 feet of water, shoaling to 4 feet at the twelfth mile, then through a flat with about 2 feet to the mouth of the river at the sixteenth mile.

Variation of water surface, about three-fourths of a foot.

The project contemplates a navigable waterway 5 feet deep and 40 feet wide, at a cost of $30,000.

During the year 145,983 cubic yards of material have been removed, giving a channel 5 feet deep and 40 feet wide for a distance of 15 miles. The project is about 85 per cent completed.

River section to Victoria, Tex.—The Guadalupe River empties into San Antonio Bay, 16 miles from the inland waterway on the coast of Texas. Its width varies from 90 feet at main entrance at mouth, increasing to 140 feet 52 miles above its mouth. The depth varies from less than 3 feet over shoals to 20 feet at bends. Thick overhanging trees, numerous snags, and sunken logs, together with rafts of recent formation, are found in the lower river. The river was formerly navigated to Victoria, 52 miles from its mouth, but owing to rafts navigation has been abandoned in recent years.

The project contemplates the removal of rafts, snags, etc., and the dredging of shoals to 5 feet, at a cost of $62,700.

During the year the U. S. combination snag boat and dredge *Guadalupe* removed 53,065 cubic yards of material and several miles of snags and rafts, clearing the river from Victoria, at mile 52, to mile 14. There has been no uniform depth obtained by this work, as the dredge has excavated only sufficient depth to enable it to proceed down the river, as the first work to be done was the removing of rafts, snags, etc.

Amount expended on existing project to close of fiscal year ending June 30, 1909, $68,258.60.

From report received from P. R. Austin, 1,150 bales of cotton and 250,000 feet of lumber, together with a considerable quantity of other supplies and products, have been transported over the part of the river at present navigable.

Report of examination is printed in House Document No. 336, Fifty-ninth Congress, second session.

(*d*) *Turtle Cove channel between Aransas Pass and Corpus Christi.*—This is a natural depression between Harbor and Mustang islands connecting at high tide the waters of Aransas and Corpus Christi bays. It is about 13,500 feet long and 2,000 feet wide, with approximate depth of 1½ feet below mean low tide.

Variation of water surface is about 1 foot.

The project contemplates a channel 8½ feet deep at mean low tide and 75 feet wide at the bottom, at a cost of $123,750.

During the year 923,068 cubic yards of material was excavated, making a channel 8½ to 9 feet deep and 75 feet wide on the bottom, from 9 feet of water in Aransas Pass Gorge near the town of Tarpon to Corpus Christi Bay, a distance of 31,400 feet.

The project has been completed.

Amount expended on existing project to close of fiscal year ending June 30, 1909, $122,107.64.

The maximum draft that can be carried at mean low tide over the shoalest part of this locality is 8½ feet.

For report of survey, see House Document No. 338, Fifty-ninth Congress, second session.

One small steamboat and several schooners use this channel in transporting freight between Galveston and Corpus Christi.

This channel not having been opened to navigation until April, 1909, practically no freight has been carried through same as yet.

July 1, 1908, balance unexpended	$284,942.83
Amount allotted from appropriation by river and harbor act approved March 3, 1909	132,000.00
Amount appropriated by sundry civil act approved March 4, 1909	55,000.00
Proceeds of sales of condemned property	.26
Proceeds of sales of contract prints	13.75
Collected from Postal Telegraph Cable Company for dredging trench for cable	500.00
	472,456.84
June 30, 1909, amount expended during fiscal year, for works of improvement	266,222.79
July 1, 1909, balance unexpended	206,234.05
July 1, 1909, outstanding liabilities	19,861.99
July 1, 1909, balance available	186,372.06
July 1, 1909, amount covered by uncompleted contracts	18,000.00
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1909	100,000.00

Report of Board of Engineers, printed in Rivers and Harbors Committee Document No. 3, Sixty-first Congress, second session, may be found herein under heading "Waterway Mermentau River to Sabine River."

CHANNEL FROM ARANSAS PASS HARBOR TO CORPUS CHRISTI, TEX.

Following is the letter of the Chief of Engineers submitting report on a recent survey, printed in House Document No. 678, Sixty-first Congress, second session:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS.
Washington, February 9, 1910.

SIR: I have the honor to submit herewith for transmission to Congress reports dated June 16, 1909, and January 3, 1910, by Capt. J. C. Oakes, Corps of Engineers, on preliminary examination and survey made in compliance with an item in the river and harbor act of March 3, 1909, which called for an examination of a channel from Aransas Pass Harbor through Turtle Cove to

Corpus Christi, with a view to obtaining a channel 25 feet deep and of the necessary width.

The river and harbor act of March 2, 1907, adopted a project for a channel from Aransas Pass through Turtle Cove 8½ feet deep and 75 feet wide, the object of the improvement being to give an outlet for the commerce of Corpus Christi. This work has been completed, a channel 6 miles in length having been excavated, at a cost of about $122,000. Persons interested in the improvement now proposed claim that the improvement already effected is not sufficient to permit of economical navigation between Corpus Christi and Galveston.

In the opinion of the district officer a channel from Aransas Pass to Corpus Christi 25 feet deep would have to be at least 200 feet wide in order to permit navigation by vessels suited to the depth mentioned. It is his opinion, moreover, that in order that the channel might be reasonably safe for vessels requiring a depth of 25 feet the channel should be 300 feet wide. Estimates for channels of the dimensions above mentioned were submitted by the district officer, the amounts being $2,443,202.60 and $3,340,409.40, respectively. In view of the great cost of providing channels of the sizes mentioned, the difficulty of their maintenance, and the possibility of providing a suitable deep-water port in closer proximity to Aransas Pass which would adequately serve the interests of the adjacent country, the district officer was unable to recommend the adoption of either of these projects. Believing, however, that such improvement as could be effected at reasonable cost was justifiable, he recommended a channel 150 feet wide and 15 feet deep, to cost $541,850.20.

The Board of Engineers for Rivers and Harbors was unable to agree with the district officer as to the advisability of providing the channel recommended by him, since to obtain a depth of 15 feet would require dredging a distance of about 20 miles, for half of which distance the channel would be in the most exposed part of Corpus Christi Bay. Estimates were therefore made for a channel 12 feet deep and 150 feet wide, which will cost $271,900 with an annual maintenance charge of $50,000, and a channel 12 feet deep and 100 feet wide, which will cost $207,900 with an annual maintenance charge of $35,000. The distance over which dredging would have to be done under these projects would be almost 10½ miles. After considering the matter further, the board concluded that the benefits to general commerce at this time would not be sufficient to justify the undertaking of the work in question.

After considering all the facts, including the amount of commerce potentially tributary to this locality, I have to report that in my opinion it is not advisable for the Government to undertake at this time the excavation of a channel 25 feet deep from Aransas Pass through Turtle Cove to Corpus Christi. However, in view of the great cost and present condition of Aransas Pass Harbor and the probable length of time that will elapse before a deep-water port with proper railway feeders and terminal facilities can be provided in close proximity to the harbor entrance at Aransas Pass, it is my opinion that it is advisable for the General Government to provide a channel from Aransas Pass through Turtle Cove to Corpus Christi 12 feet deep and 100 feet wide, at a cost of $207,900, with $35,000 annually for maintenance. This work should be regarded as experimental to a certain extent and undertaken in order to secure some immediate benefit from the large expenditure made at the Aransas Pass Harbor entrance in advance of the creation of a deep-water port in that vicinity.

Attention is invited to the fact that the $207,900 estimated as the cost of the channel recommended by me includes an item of $50,000 for a government dredge. The entrance of the channel from Turtle Cove to Corpus Christi Bay is exposed and will shoal constantly, and if a channel of this depth is to be maintained at all, a dredge must be available for the prompt removal of shoals as quickly as they form. My recommendation of this project should be understood as based on the supposition that such legislative action will be taken as will allow the channel to be properly maintained at the depth recommended.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

CYPRESS BAYOU, TEXAS AND LOUISIANA.

During the period of the great raft in Red River the bottom lands of Cypress Bayou were flooded—became lakes—and afforded a navigable route from Red River, near Shreveport, La., to Jefferson, Tex., 65 miles. Work by the United States for the improvement of this route commenced in 1872, and from 1872 to 1879 $94,000 was appropriated for the purpose. The funds were expended for dredging and straightening the channel, removing stumps, snags, and logs, and cutting leaning timber. This work was completed in 1880, but on account of its temporary nature appropriations and allotments aggregating $39,701.33 were made for maintenance.

The removal of the raft and the subsequent closure of outlets and construction of levees down the right bank of Red River from the hills in Arkansas to near Shreveport, La., cut off the water supply of the lakes, which, in conjunction with the quicker drainage resulting from the lowering of the bed of Red River, gradually caused them to dry up. In consequence the period of navigation shortened from year to year until 1897, when boats from Red River ceased plying altogether.

The existing project is practically for maintenance by cleaning and clearing the bayou and lakes between Jefferson, Tex., and Mooringsport, La., of snags and other recurring obstructions.

The amount expended to June 30, 1909, was $142,824.28 for improvement and maintenance and $12,613.05 for surveys. The work of maintenance so merges into the work of improvement that it is difficult to state just what portion of the expenditures was for maintenance and what for improvement.

The water supply of the drainage basin of the lakes has been reduced so greatly and the channel of Red River above Shreveport has lowered so much that steamboats now can cross Albany flats, at foot of the lake, only at rare intervals during exceptionally high stages of Red River or after heavy rains in the drainage basin of the lakes.

The work of removing obstructions now in progress has rendered navigation safer between Jefferson and Mooringsport and has consequently caused come increase in the quantity of such local navigation. This navigation, by giving access to a competing railroad, has resulted in keeping freight rates somewhat below those existing in neighboring sections.

From August, 1908, to February, 1909, the quarter boat was engaged in removing obstructions to navigation between Jefferson, Tex., and Mooringsport, La. The remainder of the time the boat was out of commission on account of high water and lack of funds.

The amount estimated for maintenance of improvement during the fiscal year ending June 30, 1911, is for continuing the work of cleaning the channel of obstructions to navigation.

July 1, 1908, balance unexpended	$3,638.02
Amount allotted from appropriation by river and harbor act approved March 3, 1909	6,000.00
	9,638.02
June 30, 1909, amount expended during fiscal year, for works of improvement	3,374.02

July 1, 1909, balance unexpended	$6,264.00
July 1, 1909, outstanding liabilities	82.19
July 1, 1909, balance available	6,181.81
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	5,000.00

WATERWAY BETWEEN JEFFERSON, TEX., AND SHREVEPORT, LA.

The following reports of the Board of Engineers, on preliminary examination and survey, are concurred in by the Chief of Engineers and printed in House Document No. 220, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., September 30, 1907.

Respectfully returned to the Chief of Engineers, U. S. Army.

The waterway between Jefferson, Tex., and Shreveport, La., about 65 miles in length, consists of Cypress Bayou, Fairy Lake (now called Caddo Lake), Big and Little Willow Passes, Soda Lake, Twelvemile Bayou, and Red River. Many years ago this waterway was navigable practically the year round, and Jefferson was an important shipping point, its water-borne commerce being quite large. The removal of the raft in Red River resulted in the cutting out of its bed and the consequent lowering of its surface, which was followed by the partial draining of the waterway between Jefferson and Shreveport, as this was connected in many places with Red River. This lowering of the water surface has now reached a point which practically prevents navigation in the lower part of the waterway, but the upper portion from Jefferson to the foot of Caddo Lake is still navigable for light-draft vessels practically the year round. The slope of this section is very slight and the construction of the dam now proposed would convert this into a pool some 38 miles in length.

Much of the slope between Caddo Lake and Shreveport is concentrated in a short distance in what is known as the "falls," which is in effect a series of rapids. Owing to the sedimentary nature of the material over which the rapids pass they are constantly working upstream, draining the pools as they proceed. It appears evident that if this process continues the falls will eventually reach and drain Caddo Lake and Cypress Bayou, and destroy the existing navigation between Jefferson and Mooringsport. The object of the proposed dam is to maintain a navigable depth through Cypress Bayou and Caddo Lake, and to arrest the progress of the falls at the point where the dam will be located.

Several plans have recently been devised to overcome the difficulties of navigating this waterway, but none of them have been adopted. Under authority of the act of March 3, 1905, a survey was made of a part of this waterway and a plan proposed for its improvement which involved the construction of a lock and dam at the foot of Caddo Lake and the dredging of a channel from that point to Red River. The cost of this project was thought to be in excess of probable benefits and its adoption was not recommended. Dredging in the channel below the lock and dam represented a large part of the cost of the project, this item alone amounting to $200,000 out of a total of $525,000.

The plan now proposed is the construction of a dam only, omitting the lock and dredging below. This will limit navigation to the section of waterway above the dam, but this is where the existing commerce is and where an improvement will be of greatest benefit. Moreover, if future conditions should arise making it desirable to carry navigation through to Shreveport, a lock could be constructed in connection with the dam as formerly proposed.

This waterway has been under improvement for a number of years, about $140,000 having been expended. The preservation and further improvement of navigation between Jefferson and Mooringsport is particularly desired, as this will stimulate competition with the railroads at those two points. Experience in this section of country indicates that competition thus created and maintained will result in considerable reduction in freight charges and material benefits to the community.

The amount of commerce now existing on this waterway is not large, due in a measure at least to the unsatisfactory and unreliable condition of the chan-

nel. New industries are reported at Jefferson and new mills on the lake and bayou, and it is believed from information presented that the proposed improvement would result in the development of sufficient commerce, coupled with its influence on freight rates, to justify the United States in undertaking the work, unless it should appear upon further examination that the cost of the dam will be excessive. The district officer states within that the cost of the dam would be about $100,000. It is presumed that the estimate is taken from the former survey and is approximate, and, therefore, it is recommended that the district officer be given an opportunity to revise it if deemed necessary. It is believed that no additional funds will be required for this purpose.

———.

WASHINGTON, D. C., *November 11, 1907.*

Respectfully returned to the Chief of Engineers, U. S. Army.

The district officer confirms the approximate estimate contained in his report on preliminary examination, which places the cost of the dam at the foot of Caddo Lake at $100,000.

Believing this amount is not unreasonable when compared with probable benefits, the Board is of opinion that it is advisable for the General Government to undertake the improvement of the waterway connecting Jefferson, Tex., with Shreveport, La., by the construction of a dam at the foot of Caddo Lake, as proposed by the district officer.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

Speaking of this improvement, Hon. O. B. Colquitt, a member of the railroad commission of the State of Texas, says:

I assume that with the navigation of Cypress Bayou up to Jefferson that the same rates would apply to Jefferson that now apply to Shreveport, La. Estimating the benefits accordingly, I think that 20 per cent of the freight charges between the points named above would be saved to shippers, or a sum approximating $250,000 per annum would be saved to the people of that section of Texas. With navigation up to Jefferson I am of the opinion that the traffic passing through that place and on to the stations between those named on the Texas and Pacific would increase 20 per cent over the amount given in the figures above.

I have not heard from the auditor of the Cotton Belt road, but think it safe to say that with the navigation of Cypress Bayou up to Jefferson, and with water rates applying to that point, the rates prescribed by the Texas railroad commission would base on Jefferson, and all north Texas rates would be reduced from 10 to 33⅓ per cent on those which now apply to that section. In many cases the reductions would even be greater, and the saving, in my humble judgment, would easily equal one-half million per annum to the freight payers of north and northeast Texas.

Assuming that Mr. Colquitt's computations are correct, and assuming further that the improvement to be made on Sulphur River will give half the estimated benefits without any improvement of the Cypress, it would still appear as if this improvement would result in a saving of $250,000 a year to the inhabitants of northeast Texas.

SULPHUR RIVER, TEXAS AND ARKANSAS.

Sulphur River for about 150 miles from its mouth is from 150 to 200 feet wide, with navigable depths, except for a few shoals. The banks are as a rule firm and stable. The stream is, however, badly obstructed by snags and sunken logs.

In 1896 and 1897 the sum of $2,488.99 was expended on snagging operations.

The existing project was adopted by the river and harbor act of March 2, 1907, and contemplates improvement of 150 miles of the river above the Red River by dredging and operation of a snag boat, at an estimated cost of $36,000, assuming that a United States boat is available. Operations during the year consisted in removal of snags and other obstructions by means of a quarter boat.

At the close of the fiscal year $16,968.81 had been expended on this project.

Owing to the poor navigable condition of the stream at present no commerce of any account has developed. As the stream drains a very rich section of the country it is expected that it will be extensively used when improved, and that some reduction in freight rates will result.

It is proposed to expend the available funds and the additional appropriation recommended in clearing the river of obstructions and dredging where necessary.

For reference to reports of examinations and surveys see Annual Report of the Chief of Engineers for 1907, page 457.

July 1, 1908, balance unexpended	$27,860.84
June 30, 1909, amount expended during fiscal year, for works of improvement	8,829.65
July 1, 1909, balance unexpended	19,031.19
July 1, 1909, outstanding liabilities	430.30
July 1, 1909, balance available	18,600.89
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	15,000.00

OUACHITA RIVER, ARKANSAS AND LOUISIANA.

The improvement of Ouachita River by the United States commenced in 1871. At that time navigation was much obstructed at all stages by snags, sunken logs, wrecks, leaning and caving trees, etc., and the greater part of the river was unnavigable at low water on account of numerous rock, gravel, and sand bars.

The project of 1871 contemplated temporary improvement from Trinity, La., to Arkadelphia, Ark., by removal of snags, etc., and by dredging the worst bars. In 1872 a project was adopted for locks and dams to give 4 feet depth from Trinity, La., to Camden, Ark., but was abandoned two years later. The project under which work continued after 1874 contemplated the removal of snags, logs, wrecks, leaning timber, etc., obstructing navigation below Camden, Ark. The 56 miles known as Black River, below Trinity to Red River, Louisiana, was added to the project in 1884. The amount expended on the original and modified projects prior to operations under the existing project was $614,802.19.

The existing project, besides a continuation of snagging work, contemplates the construction of eight locks and movable dams to afford a navigable depth of 6½ feet from the mouth of Black River, Louisiana, upstream to a point 10 miles above Camden, Ark. (360 miles), as set forth in House Document No. 448, Fifty-seventh Congress, first session (Report Chief of Engineers, 1902, p. 1435). The change

of site of Lock and Dam No. 2, referred to in last year's report (Report Chief of Engineers, 1908, p. 490), will eliminate Lock and Dam No. 1 from the project. The latter was adopted in part by provisions of the river and harbor acts of June 13, 1902, and March 3, 1905, authorizing continuing contracts for building Lock and Dam No. 4, near Monroe, La., and Lock and Dam No. 6, near Roland Raft, Ark., completing the survey for locks and dams, and maintenance of prior work. The river and harbor act of March 2, 1907, authorized continuing contracts for the construction of Lock and Dam No. 2, near Catahoula shoals, Louisiana, and Lock and Dam No. 8, near Franklin shoals, Arkansas.

The amount expended under the existing project to June 30, 1909, was $516,802.10 (including $1,750.26 derived from sales). Of this amount $11,786.73 has been applied to completion of survey and $122,471.29 to maintenance.

A contract for building Locks and Dams Nos. 4 and 6, let September 7, 1904, provided for their completion by December 31, 1906, but this time limit was waived. Work commenced October 28, 1904, but abnormally high-river stages limited the time of actual construction to two hundred and ten working days during the fiscal years 1905, 1906, 1907, and 1908. Previous gauge records for fourteen years, from July, 1890, to July, 1904, showed the yearly average working stage (below 10 feet on the Monroe gauge) to be one hundred and forty-one working days. On June 30, 1908, the condition of the work was as follows: On the basis of work done, Lock and Dam No. 4 about 20 per cent completed, Lock and Dam No. 6 about 8 per cent completed. On the basis of work done and material delivered, Lock and Dam No. 4 is about 31 per cent completed, and Lock and Dam No. 6 about 11 per cent completed. Nothing further was done by the contractors, and their contract was terminated by an agreement dated October 22, 1908, under which the contractor's plant, material, and buildings were transferred to the United States. Construction work at Lock No. 4 was undertaken at once by hired labor, but the date on which the contract was terminated, the condition of the plant and cofferdam left by the contractor precluded the hope of accomplishing any important amount of permanent construction during the low-water season of 1908. Barges, machinery, camp buildings, etc., were repaired, and as soon as the necessary plant could be prepared the work of reenforcing the cofferdam made necessary by scour in the river was commenced and continued during the remainder of the season. Since the termination of the low water in February, 1909, further work was continued in preparing plant, buildings, and material for active operations during the coming low-water period.

Proposals for building Lock 6 were advertised for two months, but only one bid was received, aggregating $213,190.50, upon the estimates of quantities used for canvassing bids. The price bid for concrete work, which is the controlling factor, was considerably in excess of the corresponding unit price in the contract of 1908 for Lock 2, and, after reserving from the appropriation the amount necessary for completing Lock 4 without the dam, the balance available was insufficient to cover the cost of the construction contemplated at Lock 6, and the bidder declined to perform a less amount of work at his unit prices. Paragraph 10 of the sundry civil act approved March 4, 1909, rendered funds which it was expected to employ for work at Lock 6

not available, but this difficulty was removed by Congress and information relative thereto furnished the district officer June 28, 1909.

On account of the longer time required for construction of Locks and Dams 4 and 6 than originally estimated, due to the failure of the contractors to complete their contract, together with the scour which has taken place in the river at Lock and Dam No. 4 coincident with this delay, and on account of additions to the original designs thought necessary to secure the work, etc., the amount estimated as required to complete the existing project as far as it refers to these two locks and dams has been increased $439,000.

Proposals for building Lock and Dam No. 2 at Harrisonburg, La., were advertised for two months, and two bids for the work were received; but they exceeded the sum authorized for construction of both lock and dam, and a contract was made August 7, 1908, with the lowest bidder, to build the lock alone at an estimated cost of $296,694.50, exclusive of engineering and contingencies. This contract provides for completion of the lock within two hundred and fifty working days during which natural conditions are such as to permit work inside of the cofferdam. The contractor commenced work promptly and erected camp buildings, assembled plant, and commenced the construction of the cofferdam. The latter work was continued as the river stage permitted until February 6, when the round piling therefor had been driven and the upper line of waling placed with the exception of a 60-foot gap left for the passage of barges. During the remainder of the year the contractor continued preparations for further work during the coming low-water season.

At Lock No. 8 work by hired labor, which was commenced in December, 1907 (see report for 1908, p. 1570), was continued, and the mound, the machine shop, and all camp buildings except an auxiliary cement storehouse at the concrete-mixer platform were completed. On June 30, 1909, the cofferdam, except a gap of 40 feet at the lower outer corner, and excavation for the lock foundation were practically completed. A considerable amount of material for permanent construction, including round and sheet piling, sand and gravel, cement, and embedded metal had been procured and further preparations made for proceeding with permanent construction.

During the fiscal year ending June 30, 1909, snagging work for maintenance extended from the mouth of Black River, Louisiana, to Camden, Ark., 350 miles upstream, with greatly beneficial results, and about 5,141 cubic yards of mud and gravel were excavated from the channel at Catahoula shoals, Louisiana, in making a cut 60 feet wide and 450 feet long. This work increased the depth from about 40 inches to near 9 feet.

Besides the slack-water improvement the work heretofore done has consisted chiefly of the removal of snags, logs, wrecks, leaning timber, tree slides, etc., for the purpose of maintaining navigation and the improvement of Catahoula shoals, a rock and gravel bar about 20 miles above Trinity, La., where the available depth at low water was increased from 15 to 40 inches. At moderately high stages, or for six to seven months of the year, New Orleans steamboats ascend the river to Camden, Ark.; at medium stages they run to Monroe, La., but during the periods of low water Harrisonburg, La., 72 miles above Red River, is considered the head of navigation, though small local packets make trips between points on the river above. The

maximum draft that can be carried at mean low water is 3½ feet to Harrisonburg, La., 1¼ feet to Monroe, La., and 8 inches to Camden, Ark. The range between high and low water at the several gauge stations on Ouachita River is as follows: Camden, Ark., 44.2 feet; Monroe, La., 48.6 feet; Riverton, La., 51.3 feet, and Jonesville, La., 54.1 feet. Camden, Ark., is considered the head of navigation, but at high stages the river is navigable, in fact, to Arkadelphia, Ark.

The commerce of Ouachita River and its tributaries is considerable, and consists of shipments of cotton, cotton seed, lumber, staves, saw logs, and miscellaneous articles, with return freights of general merchandise and plantation supplies. Most of the cotton is shipped to New Orleans, and large quantities of staves for export are sent to that city. The volume of commerce, as reported for nineteen years, ranges between 73,679 and 313,863 tons per annum, with values estimated at $3,243,200 to $10,234,250. The average is 176,968 tons, valued at $6,220,150. The variations are due to crop yields, the uncertainty of navigation, droughts, and other causes, and the improvement by locks and dams is for an extension of benefits by affording navigation to Camden the year round.

The project has effected a reduction of railroad rates from New Orleans to Monroe, La., and points below to meet the steamboat rates. The territory above Monroe was opened to railroad traffic a few years ago, but the lines as yet have not met the water rates. During periods of navigation the rate on cotton from Monroe to New Orleans is $1.25 per bale, but when navigation is suspended this rate is advanced to $1.75 per bale. Railroad rates from Monroe, La., to inland towns, as a rule, are greatly in excess of those to points where there is water competition.

For more extended information respecting this improvement, reference is invited to the report of 1895 (p. 1887) and to subsequent reports of the district officers.

An index to reports of examinations and surveys was published in the Report of the Chief of Engineers, 1904, page 389.

The estimated amount of $513,000 that can be profitably expended in the fiscal year ending June 30, 1911, in addition to the balance unexpended July 1, 1909, will be applied to continuing construction of locks and dams; to removing obstructions, including snags, overhanging trees, drift, etc.; and to maintaining and operating snag and dredge boats. This additional work is necessary to make the improvement available and for maintenance and the extension of benefits.

The short working season on Ouachita River, the alluvial nature of the river bottom, which requires the use of piling for foundations in lock and dam structures, the necessity of obtaining detailed information as to the character of the underlying material, and the desirability of making tests, plans, and local surveys render it advisable to have funds available for expenditure in preliminary work at lock and dam sites proposed in the general project for improvement other than those for which funds have been provided. Such a provision would expedite the work when funds for construction are provided and would permit of an economical arrangement for labor and plant. It is recommended that $8,000 be provided for these purposes.

July 1, 1908, balance unexpended		$664,245.11
Amount received from sales of property		177.65
Amount appropriated by sundry civil act approved March 4, 1909		176,135.00
Amounts allotted from appropriation by river and harbor act approved March 3, 1909		160,000.00
		1,000,557.76
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$166,286.55	
For constructing snag boat	13,592.18	
For maintenance of improvement	21,664.06	
		201,542.79
July 1, 1909, balance unexpended		799,014.97
July 1, 1909, outstanding liabilities		18,812.52
July 1, 1909, balance available		780,202.45
July 1, 1909, amount covered by uncompleted contracts		302,904.32
Amount (estimated) required for completion of existing project		603,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		513,000.00

ARKANSAS RIVER, ARKANSAS.

In its original condition the channel of the river was greatly obstructed by shifting sand bars and numerous snags in its lower reaches, and by gravel and rock shoals and some snags in its upper reaches. Navigation was difficult and uncertain at medium and low stages, and during periods of extreme low water was impossible.

Prior to act of Congress approved June 13, 1902, the work on this river was carried on under two general projects—one entitled "Removing obstructions in Arkansas River, Arkansas and Kansas," the other "Improving Arkansas River, Arkansas."

The original project for "Removing obstructions in Arkansas River, Arkansas and Kansas" (act July 3, 1832), was to remove snags and wrecks. Subsequently this project was enlarged to include removing bars by wing dams, and many of the appropriations were made for this work in combination with other rivers. By act of March 3, 1879, Congress adopted an additional project—that of improving the river between Fort Smith, Ark., and Wichita, Kans., by removing the snags and rocks and constructing dams at some of the worst shoals. Later these projects were merged into one, making the project extend from the mouth of the river to Wichita. Under these projects there was expended to June 30, 1902, $968,256.81.

The original projects for "Improving Arkansas River, Arkansas," were local and had in view the permanent improvement of the river at Fort Smith, Van Buren, Dardanelle, and Pine Bluff. By act of August 11, 1888, Congress adopted a general project, namely:

That the Secretary of War shall expend the appropriation under this head with reference to the final improvement of this river as contemplated in the Report of the Chief of Engineers for the year ending July first, eighteen hundred and eighty-five, and as authorized in the act for the improvement of rivers and harbors approved August fifth, eighteen hundred and eighty-six, and in House Executive Document Numbered Ninety, Forty-ninth Congress, first session; said methods to be applied as the Secretary of War may direct at such points between Wichita, Kansas, and the navigable mouth of the Arkansas River at its junction with the Mississippi River as he may deem for the best interest of commerce.

The "said methods" referred to in the act were "to remove rock and gravel reefs by blasting and dredging, to contract the channel by dikes and dams, permeable or solid, of such construction as the local conditions require, and to hold the channel so obtained by revetment where necessary." The improvement authorized by the act covers 771 miles, while estimates have been rendered for 708 miles, thus making the estimated cost of the improvement under this project indefinite. Act of August 18, 1894, authorized the operation of snag boats under this head in addition to similar operations under the project "Removing obstructions in Arkansas River, Arkansas and Kansas." To the close of the fiscal year ending June 30, 1902, there had been expended under the general project for improving Arkansas River, Arkansas, $903,311.93 for original construction, $314,119.14 for maintenance, and $63,397.32 for operating snag boats, making the total amount $1,280,828.39.

Act of Congress approved June 13, 1902, merged these two general projects into one, which makes the existing project in substance: "The improvement of the river from its mouth to the head of navigation by snagging operations, by dredging operations, and by contraction works, holding the improved channel by revetment where necessary." No definite estimate of cost can be given.

The river and harbor act of March 2, 1907, made available for maintenance of this improvement amounts previously appropriated for work in vicinity of Redfork levee or set apart for dredging. The act provided also for an examination of the river to Muskogee, Ind. T., by a Board of Engineers, with a view to devising a plan for further improvement, and made a conditional appropriation for work at Pine Bluff, if deemed by the Board to be necessary in the interest of navigation. Funds from this appropriation were applied to work in pursuance of the Board's recommendation, and report on the subject will be found on pages 538 and 539 of this report under the heading "Arkansas River at Pine Bluff and White River at Augusta Narrows, Arkansas."

To June 30, 1909, there had been expended under the consolidated project for Arkansas River $227,795.57, of which $169,204.29 was for operating snag boats, $38,121.28 for operating a hydraulic dredge, and $20,470 for maintaining works of permanent improvement. The total expenditures under all projects to June 30, 1909, is $2,476,880.77, of which $1,200,858.42 is for operating snag boats, $38,121.28 is for operating a hydraulic dredge, $903,311.93 for original construction of works of permanent improvement, and $334,589.14 for maintenance of those works. Other expenditures on this river are shown in this report under the headings "Arkansas River at Pine Bluff and White River at Augusta Narrows," page 538 of this report, and "Arkansas River at Pine Bluff," page 539 of this report. After expending $1,237,901.07 in the construction and maintenance of works, the permanent improvement of the stream was abandoned before completing the project. Snagging operations have improved the channel in the permanent reaches; in other localities the improvement has been temporary and must be repeated from time to time.

Fort Gibson, on Grand River, 2 miles above its mouth and 463 miles from the mouth of the Arkansas River, is the head of steamboat navigation. The duration of the navigable periods of the river varies greatly in different years. Occasionally there are periods of

very low water, when navigation will be suspended throughout the length of the river, and then there will be times when it is possible to maintain 3-foot navigation through to Fort Gibson all the year. Generally the maximum draft that can be carried at ordinary low water is 3 feet from the mouth of the river to Pendleton (42); 2 feet from Pendleton to Swan Lake (80); 1½ feet from Swan Lake to Webbers Falls (430); and 1 foot from Webbers to mouth of Grand River (461). The periods of navigation by steamboats are of about the following averages:

	Months a year for 4-foot draft.	Months a year for 2-foot draft.
Mouth to Swan Lake (80 miles)	5¼	10
Mouth to Little Rock (174 miles)	5	9¼
Mouth to Grand River (461 miles)	4	8

The range between extreme high water and extreme low water at Fort Smith, Ark., is 35.5 feet; at Little Rock, Ark., 28.5 feet; and at the mouth of the river, where the stages are controlled by those of the Mississippi, the extreme range is 53.7 feet.

The operations of this fiscal year consisted in snagging operations, and in dredging operations with a hydraulic dredge borrowed from the Mississippi River Commission. The snag boats *Arkansas* and *C. B. Reese* operated below Spadra (290), removing 2,217 snags from the channel, cutting 22,038 trees on caving banks, and breaking up 9 drifts. A chopping party working between Fort Smith (369) and mouth of Grand River (461) removed 912 snags, cut 320 trees, and destroyed 35 drift piles. The hydraulic dredge *Gamma* was operated at three localities, but the principal work was done at Rob Roy (99). Here the main channel of the river had left the draw spans of the railway bridge and only a secondary channel behind a middle bar afforded a passage for boats through the draw openings of the bridge. The dredge opened this secondary channel, and notwithstanding this unfavorable condition the dredged channel has remained open to the close of this fiscal year, but for fifteen days (October 10–24) during the lowest water period of this fiscal year the dredged cut did not afford a navigable channel. The dredged cuts made at the other two localities were obliterated in the freshet of October 25–November 3, 1908. Because of having to return the borrowed dredge to the Mississippi River Commission about the 1st of August each year there has been no opportunity in the two seasons it has been operated in this river to fully try out its work during low-water periods; but judging from such dredging as has been done it appears that by such operations much material aid can be given to navigation by lengthening the navigable periods of the river. The district officer recommends that two dredges be provided for the river below Little Rock, 174 miles.

The Muskogee-Oklahoma Packet Company, which was organized for the purpose of operating a boat line between Fort Smith and Muskogee, built a boat but did no business during the year. The Little Rock Packet Company has been organized for the purpose of operating a boat line out of Little Rock. It has purchased two boats.

The Arkansas River Packet Company became bankrupt during the year and the Memphis and Pine Bluff Packet Company has taken its place.

Commercial statistics, year ending May 31.

Year.	Tons.	Value.	Year.	Tons.	Value.
1894	63,563	$2,846,395	1902	40,556	$1,630,297
1895	50,498	2,380,420	1903	86,068	2,389,020
1896	54,261	2,408,720	1904	92,041	2,078,893
1897	66,077	1,657,218	1905	86,458	1,636,980
1898	58,578	1,626,756	1906	103,214	1,512,719
1899	68,057	2,470,131	1907	104,593	2,192,531
1900	75,654	2,078,940	1908	103,919	2,150,269
1901	71,998	2,623,797	1909	92,456	2,122,105

Rafted saw logs floated with the current made up 60 per cent of the commerce reported and represent 6 per cent of the estimated value. Plantation products and supplies and timber products made up the steamboat commerce. It does not appear that the improvement of the river in late years has had any marked effect on intrastate freight rates, either by water or by rail. In 1900 and 1901 the improvement of the river reached its highest state of development. Since that time the permanent works have been permitted to deteriorate, and the snag boats working alone have not been able to extend the development any. The intrastate rail rates are controlled by a state railway commission and are based on a "standard distance tariff," and the river is not taken into consideration in making this tariff. This statement applies to all the rivers in the State of Arkansas.

The balance available July 1, 1909, will be expended in snagging operations. The amount estimated for the fiscal year June 30, 1911, is for snagging operations, procuring additional plant, and maintaining permanent works at Pine Bluff. The "additional plant" referred to is a small snag boat to cost $30,000 for use in the upper Arkansas, but for reasons stated by the district officer this expenditure can be postponed until a further need of the boat is shown. The district officer states that there is a permanent need for a revetment plant on this river for use in maintaining works already built as well as for use in preventing cut-offs. He makes no estimate of the cost of a suitable plant, presumably withholding such estimate until Congress takes some action upon the reports of the several preliminary examinations that have been ordered for this river.

References to the principal examinations and surveys of this river are given on page 401 of the Annual Report for 1904.

July 1, 1908, balance unexpended	$53,397.85
Receipts from sales	9.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	35,000.00
	88,406.85
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	[a] 48,970.05
July 1, 1909, balance unexpended	39,436.80
July 1, 1909, outstanding liabilities	8,620.43

[a] Snagging, $33,805.34; dredging, $15,164.71.

July 1, 1909, balance available	$30,816.37
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	[a] 81,000.00

Report on a recent survey of Arkansas River between Little Rock and Ozark, Ark., is printed in House Document No. 510, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, January 8, 1910.

SIR: I have the honor to submit herewith for transmission to Congress, reports by Maj. M. L. Walker, Corps of Engineers, dated May 27, 1909, on preliminary examination, and July 31, 1909, with plans and estimates of cost of improvement, called for by the river and harbor act approved March 3, 1909, of Arkansas River between Little Rock and Ozark, Ark., with a view to improvement of navigation by locks and dams, or otherwise.

This stretch of river is included in the general project for improvement of Arkansas River, which provides for snagging operations, dredging, construction works, and holding the improved channel by revetment where necessary. This project is definite as to methods only and is indefinite as to depths. Experience indicates that the work done under this project has failed to afford necessary facilities for navigation, and that the depth now desired, 3½ feet at low water, will not be obtained.

Under the act of March 2, 1907, an examination of the Arkansas River to Muskogee, Ind. T., was made by a Board of Engineer officers, which reported, in effect, that the only way in which a radical and permanent improvement can be obtained is by the use of locks and dams above Little Rock and open-river improvement below; but while such an improvement was considered entirely feasible, it was not deemed advisable on account of the great cost of the locks and dams. The Board was also of opinion that by means of hydraulic dredging it was feasible to obtain a considerably improved channel between Muskogee and Little Rock, as well as between Little Rock and the mouth of the river, and, in view of the comparatively small cost of this method and the success attending it on the Mississippi River, it was recommended.

The district officer submits three plans for improving the river between Little Rock and Ozark—by dredging, by permanent works, and by a combination of dredging and permanent works. He finds from a study of the low-water condition of the river and an analysis of reports on dredging in the lower Arkansas, on the Mississippi, and on the Ohio that seven dredges would be required to fairly maintain a channel 3½ feet in depth on the stretch of river under consideration; and that to obtain the same results by combining dredging with permanent works two dredges would be required. The district officer recommends the improvement by the combined method as desirable.

In the opinion of the Board of Engineers for Rivers and Harbors, which has reviewed the reports as required by law, the cost involved in any one of the plans of improvement outlined by the district officer is greater than the General Government would be justified in expending on this reach. While recognizing the difficulties and large cost of securing any radical improvement of a stream having the characteristics of the Arkansas River, the Board nevertheless believes that the efforts being made by local interests are deserving of some recognition if any relief or benefits can be afforded at a cost commensurate with such benefits, and recommends a method by which navigation may be aided and encouraged at a cost less disproportionate to the commerce to be anticipated in the near future.

In the report on the Arkansas River called for by the river and harbor act of March 2, 1907 (see H. Doc. No. 71, 61st Cong., 1st sess.), the Board gave as its opinion that any expenditures Congress decided to make for the improvement of this river should be for dredging, and that the work should be undertaken tentatively by the use of two dredges on the reach below Little Rock. As the object of the tentative dredging proposition was to demonstrate the effective-

[a] This amount may be reduced by $30,000 for reasons given in text above and in Appendix W 1.

ness of improving the channel by this method, the Board now recommends that the field of operations be extended to Ozark and that the two dredges suggested be used where they will best serve the purpose for which intended. It is believed that this plan will determine the practicability of improving navigation at a reasonable cost, and will, at the same time, aid and encourage navigation between Little Rock and Ozark. The estimated cost of the work proposed is $349,000 for plant, with $118,700 annually for operating expenses.

I concur in the recommendation of the Board of Engineers for Rivers and Harbors.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

THE SECRETARY OF WAR.

The following is from the report of the engineer officer in charge of the preliminary examination:

The commercial history of the Arkansas River is like that of all the rivers of the Mississippi Valley. In the early days of the settlement of the country it was the important avenue of commerce, and beginning with the year 1825, when the first steamboat passed to above Little Rock, river commerce grew with the growth of the adjacent country until about the year 1870, when the extension of railways into and along the valley caused it to begin to decline. At present there is no river commerce of any importance above Little Rock, such business as there is being done by a boat of 86 net tons registry, which makes trips only when freights are assured it. This condition was brought about by a combination of causes: First, when the country was thinly settled railways delivered freights promptly and with a greater degree of certainty than the boats; second, boat owners and local communities did not improve terminal facilities to meet the conveniences afforded by the railways; third, railways made special "cutthroat" rates to points where boat competition was strong, and in more than one instance placed opposition boats in the trade, operating them at a loss for the purpose of causing the individual boat lines to withdraw from the river; and last, although knowing that the railway special rates would exist only so long as the packet boats were operated, shippers deserted the boats. Now the commerce of this section has grown to such an extent that the railways can not—or do not—handle the freights promptly, and in the absence of active river competition there has been a gradual increase in rail rates for the past five years.

Notwithstanding this, boat owners, on account of having been in the past lured into the territory under promises of being given a part of the trade only to find themselves entirely deserted when the "cutthroat" rates were put on by the railways, do not attempt to operate regularly, but instead only make trips on positive assurance of a certain quantity of freight. This section of the country has lately begun to realize that it has been pursuing a "penny wise and pound foolish" policy detrimental to its future progress. Therefore, a short time ago there was organized at Little Rock a navigation company, known as the Little Rock Packet Company. This company purposes the mining, transporting, and selling of coal in addition to transporting such other freights as may be offered it. Its field of operation is to be from Ozark to the mouth of the river whenever stage of the river permits. The officers of this company represent that the stock has been pooled for a term of ten years, in order to insure the perpetuity and continuity of transportation upon the river. They also represent that it has leased a coal mine in the Denning district, from which the output is 300 tons a day; that it purposes to erect a loading tipple at that mine, and that a river unloading tipple is to be erected at Little Rock. The boats, two in number, have been purchased and are now en route to Little Rock from Wisconsin waters.

These boats are of the stern-wheel type and are of the same size, to wit: Net tons registry, 149; length, 134.8 feet; beam, 28.4 feet; depth of hold, 4.5 feet. By the operation of these boats the company expects to secure a more prompt movement of freights and a more equitable freight rate and to afford the "independent" coal operators opportunity to keep their coals on the market.

BLACK AND CURRENT RIVERS, ARKANSAS AND MISSOURI.

Prior to fiscal year 1905 the work on these rivers was provided for under separate appropriate titles. The works were consolidated by river and harbor act of March 3, 1905.

(*a*) *Black River.*—In its original condition this river below the mouth of Current River had, at ordinary low water, a controlling depth of 2 to 2½ feet on the shoals, but this was not available on account of snags and similar obstructions. Above the mouth of Current River navigation was practically impossible at ordinary low stages, and no rafting was possible above the Arkansas and Missouri state line.

The original project, adopted by act of June 14, 1880, contemplated removing logs, etc., cutting down shoals by means of wing dams, and closing some of the most troublesome sloughs. The estimated cost was $80,800. The only modification of the project has been that of changing the estimate to $8,000 a year for maintenance. The district officer recommends that this be increased to $18,000 for the two streams.

To June 30, 1909, there had been expended on this work $165,859.24.

Poplar Bluff, Mo., 239 miles above the mouth of the river, is the head of navigation. All-the-year navigation has been made possible to this place for boats of not over 18 inches draft. Boats of not over 2½ feet draft can navigate this river below the mouth of Current River, 116 miles, during the lowest waters, and this portion of the river is generally spoken of as being navigable for 3-foot boats at any time.

The range between high and low water at Poplar Bluff is 19 feet. This difference decreases below Poplar Bluff, and in the flat lands to the southward it averages about half of this, being 8.5 feet at Corning bridge, 70 miles below Poplar Bluff. After passing to below head of Little River the difference between high and low water increases, and at Pocahontas, 129 miles below Poplar Bluff, the difference is 26.5 feet, and at the mouth of the river it is 34.4 feet.

The operations during this fiscal year consisted in snagging operations carried on by the hand-propelled snag boat *Riverside* working between Poplar Bluff and the mouth of Current River and the snag boat *Quapaw* working below the mouth of Current River. By these operations 1,344 snags were removed from the channel, 1,816 trees cut, and 15 drifts broken up.

The report of the examination upon which the present project for the improvement of Black River is based is given in the Annual Report of the Chief of Engineers for 1880, page 1326.

(*b*) *Current River.*—The original condition of this stream was such that no steamboat navigation above the mouth of Little Black River was attempted except when the river was at high stages. Below Little Black River navigation was suspended when the river was below medium stage. The natural depths were not available on account of snags and leaning trees.

Although the United States made some improvements to this stream in 1873, and again in 1882 and 1883, the regular improvement of it was not undertaken until act of Congress of August 18, 1894, adopted a project for its improvement from Van Buren, Mo., to the mouth by snagging operations and by contracting the channel at the

worst shoals by wing dams at an estimated cost of $10,000. The appropriation of June 3, 1896, completed the amount originally estimated for the completion of the project, and all operations since then have been under estimates for maintenance. No wing dams have been built, all operations having been confined to snagging.

To June 30, 1909, there has been expended on this river $41,463.71, $7,000 of which was in the early work mentioned above, leaving $34,463.71 as the amount expended on the existing project. Of this latter amount, $24,463.71 was for maintenance.

Reference to the preliminary examination of this stream and to a subsequent examination of it is given on page 408 of Annual Report for 1904.

Van Buren, Mo., 94.5 miles above the mouth of the river, was taken as the head of navigation when the earlier projects for this river were adopted. Small gasoline boats occasionally ply the river that far up, and rafts are run over the entire river, but Pitmans Landing, near the state line between Arkansas and Missouri and 41 miles above the mouth of the river, is generally spoken of as the head of steamboat navigation. Boats can not reach that point, however, during low-water seasons, the low-water depths of the river being as follows: Three feet from the mouth to Blunts (Johnsons Landing), 25 miles; 2 feet from Blunts to mouth of Little Black River, 7 miles; and 16 inches from mouth of Little Black River to Pitmans Landing, 9 miles. From Pitmans Landing to Doniphan, 12 miles, the head of the work done by snag boats now, the low-water depths are about 12 inches.

The range between high and low water at Van Buren is about 16 feet, and this range does not vary much until below the mouth of Little Black River, when the range increases to 19 feet.

During this fiscal year the snag boat *Riverside* (hand propelled) worked over the river below state line, 42 miles. Six hundred and sixty-six snags were removed from the channel and 1,463 overhanging trees were cut.

Commercial statistics.

Year ending May 31—	Black River.		Current River.	
	Value.	Tons.	Value.	Tons.
1895	$1,065,415	132,433	$362,447	31,205
1896	891,437	111,278	227,291	29,867
1897	1,704,799	111,611	581,528	17,078
1898	788,640	115,612	306,216	52,417
1899	529,386	83,404	239,869	43,050
1900	966,961	129,698	578,834	65,043
1901	989,635	185,714	234,555	64,102
1902	919,767	166,213	165,766	37,185
1903	696,649	138,181	142,899	45,309
1904	1,092,648	191,285	139,119	55,573
1905	1,004,299	144,065	409,297	74,048
1906	625,985	139,384	152,216	47,704
1907	692,968	107,914	226,655	48,486
1908	517,905	140,826	115,398	27,696
1909	439,355	86,070	86,802	10,735

Logging and kindred industries furnished the bulk of the commerce. Of the commerce reported this year 54 per cent of that on Black River and 6 per cent of that on Current River was rafted saw logs and railway ties.

The balance available July 1, 1909, will be expended in snagging operations. The amount estimated as being needed during the fiscal year ending June 30, 1911, is for maintenance of channel by snagging operations.

CONSOLIDATED.

July 1, 1908, balance unexpended	$7,986.58
Receipts from sales	3.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	18,000.00
	25,989.58
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	6,737.03
July 1, 1909, balance unexpended	19,252.55
July 1, 1909, outstanding liabilities	490.11
July 1, 1909, balance available	18,762.44
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	19,500.00

CACHE RIVER, ARKANSAS.

In its original condition this river was much obstructed by snags, drift, and overhanging timber. The low-water depth on the controlling shoals was 6 to 8 inches.

The original project, adopted by the act of August 11, 1888, was to remove logs, snags, and overhanging timber from the mouth to Riverside (102 miles). The amount expended on this project was $9,000.

The river and harbor acts of August 18, 1894, and June 3, 1896, each authorized the Secretary of War to expend $2,000 of the White River appropriations on this stream. The funds obtained from those acts and from subsequent ones have been expended in maintenance of channel below James Ferry, 79 miles above the mouth of the river, by snagging operations.

To June 30, 1909, there had been expended on this work $19,984.36, of which $9,000 was for work under the original project and $10,984.36 was for maintenance of channel.

The operations have been of material benefit to commerce in lengthening the navigable periods by rendering the natural depths of the stream available for navigation purposes.

Gray's bridge, 95 miles above the mouth of the river, is considered the head of steamboat navigation, but the river is not navigable to that point all the year, the ruling depth in the channels over the shoals throughout the river being only 8 to 10 inches during lowest water. During high-water seasons rafts are run from 100 or more miles above Gray's bridge. In the vicinity of James Ferry (79 miles above the mouth of the river and the upper limit of snagging operations now) the range between high and low water is about 15 feet. Because of backwater from White River this range is increased to 24 feet at Rock Island Railway bridge and to 32 feet at the mouth of the river.

Reports of the more recent preliminary examinations of this river are given in the Annual Report of the Chief of Engineers for 1887, page 1547, and in the Annual Report of the Chief of Engineers for 1895, page 2037.

Commercial statistics, year ending May 31.

Year.	Tons.	Value.	Year.	Tons.	Value.
1895	12,603	$25,494	1903	16,843	$109,681
1896	20,748	62,483	1904	15,865	49,601
1897	34,990	108,460	1905	11,660	29,860
1898	10,193	36,635	1906	10,942	31,777
1899	7,667	52,936	1907	13,050	39,225
1900	11,215	29,961	1908	21,173	59,254
1901	10,374	30,100	1909	9,420	36,150
1902	15,676	40,301			

The tonnage reported this year was made up of rafted saw logs and barged railway ties.

The balance available July 1, 1909, and the additional appropriation recommended will be expended in snagging operations for maintenance of channel.

July 1, 1908, balance unexpended	$2,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	3,000.00
	5,000.00
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,984.36
July 1, 1909, balance unexpended	3,015.64
July 1, 1909, outstanding liabilities	15.64
July 1, 1909, balance available	3,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	3,000.00

ST. FRANCIS AND L'ANGUILLE RIVERS, ARKANSAS.

(*a*) *St. Francis River.*—In its original condition this stream was not navigable above Lesters Landing at any stage; between Lesters Landing and Marked Tree navigation was possible at high stages only, and below Marked Tree it was difficult at medium and lower stages and impossible at extreme low water.

The original project, adopted by act of March 3, 1871, contemplated improvement from the mouth to Wittsburg by snagging operations. For the period 1873–1882 the appropriations were made for this work in connection with White River, Arkansas. By act of June 14, 1880, appropriation was made for improving the river from Wittsburg to Lesters Landing, the project for the expenditure of this appropriation being to cut a channel through "The Lake" and clear the river of obstructions by snagging operations. Appropriation made by act of July 5, 1884, was the first separate appropriation for the entire river. The act did not state the limits within which it was to be applied. Under it snagging operations were carried on to

the town of St. Francis, Ark., and several of the sloughs or side channels were closed. When the improvement of St. Francis River, Missouri, was begun (act of August 11, 1888), Kennett, Mo., was taken for the upper limit of this work, making the existing project—

removal of logs, drifts, and snags from the channel, and overhanging timber from the banks from the mouth to Kennett, Mo., and closing the chutes and sloughs in the Sunk Lands, so as to make the river navigable at high stages to Kennett, Mo., at medium stages to Marked Tree, and at low stages to a point 30 miles below Madison, Ark., the estimated cost being $8,000 annually.

(*b*) *L'Anguille River.*—By acts of June 18, 1878, March 3, 1879, and June 14, 1880, a total of $17,000 was appropriated for snagging operations on L'Anguille River to Marianna. This was finally expended in fiscal year ending June 30, 1887. Act of June 13, 1902, revived this work and included it with St. Francis River.

There has been expended on these rivers to June 30, 1909, $121,562.03. This amount, however, does not include the expenditures on St. Francis River while it was combined with White River, as those expenditures can not be determined.

By the early operations the St. Francis River between Wittsburg and Lesters Landing was improved to such an extent that boats could reach the latter-named place on the same stage as they could the former. By subsequent operations the period of navigation below Wittsburg was lengthened about two months, and above Lesters Landing a fair high-water channel was made. The improvements thus made below Wittsburg have been maintained. No effort is being made to maintain those above Marked Tree, the commerce on that portion of the river not warranting any expenditures at this time. During periods of low water neither stream is navigable, there not being sufficient depth of water over the shoals. Marianna is the head of navigation on L'Anguille River. The head of navigation on St. Francis River is near Wappapello, Mo., about 100 miles above Kennett, Mo., the upper limit of the portion of the river covered by this project. Lying between Kennett, Mo., and Foot of Lake, 80 miles below, are the Sunken Lands of the St. Francis, one vast swamp, through which the river flows in several channels, none of which is well defined and all of which are more or less obstructed and frequently blocked. Lesters Landing is 34 miles above Foot of Lake and is the practicable head of navigation on the St. Francis River in Arkansas. Boats can pass between it and Kennett, Mo., only during high stages, and then only with great difficulty.

During this fiscal year the hand-propelled snag boat *A. B. Johnson* worked over St. Francis River between its mouth and Marked Tree, 171 miles. Nine hundred and ninety-nine snags were removed from the channel, 5,055 trees cut, and 10 drifts broken up.

Commercial statistics, year ending May 31.

Year.	Tons.	Value.	Year.	Tons.	Value.
1894	19,763	$98,375	1902	85,831	$269,199
1895	38,107	321,439	1903	88,085	294,495
1896	67,740	401,457	1904	119,172	423,469
1897	97,348	1,117,891	1905	142,098	590,560
1898	23,819	237,481	1906	137,319	472,257
1899	27,892	315,459	1907	151,015	833,397
1900	45,065	194,237	1908	286,820	1,376,757
1901	57,102	272,609	1909	160,057	1,148,855

Fifty-four per cent of the commerce reported was rafted saw logs floated with the current.

The balance available July 1, 1909, will be expended in snagging operations. The amount estimated as being needed during the fiscal year ending June 30, 1911, is for maintenance of channel by snagging operations.

July 1, 1908, balance unexpended	$6,777.97
Receipts from sales	3.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	9,000.00
	15,780.97
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	5,102.47
July 1, 1909, balance unexpended	10,678.50
July 1, 1909, outstanding liabilities	517.12
July 1, 1909, balance available	10,161.38
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	9,000.00

BLACKFISH BAYOU, ARKANSAS.

Report on a recent survey is printed in House Document No. 73, Sixty-first Congress, first session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT.
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, June 23, 1909.

SIR: I have the honor to submit herewith, for transmission to Congress, reports of April 3, 1909, and May 17, 1909, by Maj. M. L. Walker, Corps of Engineers on preliminary examination, with plan and estimate of cost of improvement, of Blackfish Bayou, Arkansas, from it mouth to Fifteenmile Bayou, as authorized by the river and harbor act approved March 3, 1909.

Blackfish Bayou is a tributary of St. Francis River, and the work of improvement proposed is the removal of snags and overhanging timber obstructing the channel, in connection with similar work now being done on the latter stream. Major Walker recommends that the present project for improvement of the main river be extended to include this navigable tributary, and that the annual estimates and appropriations for the St. Francis be increased by $500 (i. e., from $9,000 to $9,500), to cover the cost of the necessary work on Blackfish Bayou up to Fifteenmile Bayou, a distance of 6 miles.

I concur in the opinion of the district officer, the division engineer, and the Board of Engineers for River and Harbors that Blackfish Bayou is worthy of improvemet to this extent.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

Blackfish Bayou is one of the principal drainage channels for the lower portion of the St. Francis Basin. Its headwaters are in the west central portion of Crittenden County, from where it flows in a southwesterly direction through the eastern portion of St. Francis County to near the south line of that county, where it empties into St. Francis River, 44 miles above the mouth of that stream. From the St. Francis River up to the mouth of Fifteenmile Bayou—about 6 miles—Blackfish Bayou has a low-water width of 125 to 150 feet, a width of 250 to 300 feet when at bank-full stage, a low-water depth

over the controlling shoals slightly greater than that over the shoals in St. Francis River, neither stream being navigable by boats of commerce during low-water periods. The navigable stages of Blackfish Bayou up to the mouth of Fifteenmile Bayou, like those of the lower St. Francis River, are controlled by the stages of the Mississippi River, and back water from the Mississippi River gives a navigable stage in Blackfish Bayou up to Fifteenmile Bayou when the Memphis gauge reads 15 feet and above.

The commerce, present and prospective, of Blackfish Bayou consists of the movement of saw logs on barges of 600 to 800 tons burden destined to points on the Mississippi River and a small quantity of plantation products. As yet the amount of commerce arising from agricultural pursuits is small and there is no indication that it will materially increase in the near future. The commerce arising from the movement of saw logs is relatively large, since in the 6 miles of bayou under examination it amounts to 27,000 to 30,000 tons annually. The expenditure involved would represent an annual outlay of about 5 or 6 cents per 1,000 feet.

SALINE RIVER, ARKANSAS.

Report on a recent survey is printed in House Document No. 1212, Sixtieth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 5, 1908.

SIR I have the honor to submit herewith for transmission to Congress reports of September 13, 1907, and September 30, 1908, by Capt. Wm. D. Connor, Corps of Engineers, on preliminary examination, with plan and estimate of cost of improvement, authorized by the river and harbor act approved March 2, 1907, of Saline River, Arkansas, from the mouth of the same north to Turtle bar, on said river, with a view to dredging and other work.

Appropriations aggregrating $21,500 have been expended in cleaning out Saline River by removing snags, logs, overhanging timber, etc., the last work having been done in December, 1884. The further improvement now proposed consists in a renewal of these operations at an estimated first cost of $5,400, and $3,000 biennially for maintenance thereafter. No work of dredging is contemplated.

I concur in the opinion of the district officer, the present division engineer, Col. Wm. H. Bixby, Corps of Engineers, and the Board of Engineers for Rivers and Harbors that Saline River up to Turtle bar is worthy of improvement to the extent indicated.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

Saline River rises in Saline County, Ark., about 30 miles west of Little Rock, and flows in a general southerly direction through the counties of Saline, Grant, Cleveland, and Bradley to its junction with the Ouachita, its total length being close to 300 miles and its watershed approximately 3,350 square miles. From Turtle bar to the mouth of the Saline is 135 miles.

Formerly, in the seventies and early eighties, the river was the principal highway of commerce for the adjacent country. As many as 20,000 bales of cotton are reported as handled in one season. Of late years there has been little steamboating. Recently there seems to have been a revival of interest in river traffic, boats being used

even above the Cotton Belt bridge (110), where none had been previously used since the bridge was built in 1881 or 1882.

It is believed that timber in its various forms will constitute the great bulk of whatever commerce there may be, but in the condition in which the river now is it is not safe to run a raft or float a barge on even the highest water on account of the many snags, drifts, wracks, and overhanging trees. For a river with several million feet b. m. of logs in sight, to be rafted or barged, the stream is in an exceedingly bad condition.

The country adjacent to Saline River is mostly devoted to the lumber industry, but fields are rapidly taking the place of the timber.

WHITE RIVER, ARKANSAS.

In its original condition this river was much choked by logs, snags, and drift in its lower reaches, and in its upper reaches—i. e., above Jacksonport—by gravel shoals, bowlders, and some snags.

The original project (act of March 3, 1871) was to remove snags and similar obstructions, the work being combined with similar work on Black and Little Red rivers. Act of June 23, 1874, extended the improvement to Forsyth, Mo., the project being to remove snags and bowlders and to contract the water width at shoals. During the period 1873–1884 the snagging operations on the lower river were in connection with similar work on St. Francis River, while the improvement above Jacksonport was under appropriations confined to that portion of the stream. The act of July 5, 1884, was the first independent appropriation for the river as a whole. It readopted and consolidated into one the separate projects and provided for a survey with a view to the permanent improvement of the river from Forsyth, Mo., to the mouth. The project of 1888 (Annual Report of the Chief of Engineers for 1888, p. 1406) was to deepen the water on shoals by contracting the channel, and to remove rocks, bowlders, and snags from the channel, the object being to obtain a channel 5 feet deep at low water from the mouth to Newport and 2 feet deep thence to Buffalo shoals, at an estimated cost of $105,815, with an additional amount of $8,000 a year for two or three years for snagging. For reasons given in the Annual Report of the Chief of Engineers for 1891, page 2049, the estimates were inadequate to accomplish the object. The act of July 13, 1892, appropriated $53,815 to complete the project, and an additional sum of $21,185 to be expended "in the discretion of the Secretary of War." These funds and those appropriated since have been expended on the lines of the project of 1888, with the addition of dredging on the shoals. The act of March 3, 1899, adopted a lock-and-dam project for the improvement of this river above Batesville, thus reducing the scope of the former project to improving the river from the mouth to Batesville by contracting the channel, by removing rocks, bowlders, and snags, and by dredging.

It is not practicable to state the expenditures on this river when the work was carried on in connection with other rivers. From the separate appropriations for the whole river, or for reaches of it, to the close of the fiscal year ending June 30, 1909, there had been expended $448,003.13. Of this amount $362,801.57 had been expended on projects prior to March 3, 1899, and $85,201.56 had been expended on maintenance of channel below Batesville.

In a few instances the contraction works above Jacksonport gave a slight increase in channel depth, but on the whole there was not enough improvement in the channel to be of any material benefit to navigation; the dredging between Jacksonport and Batesville in fiscal year 1898 made a channel 3 feet deep during one low-water season, but the dredging has not been continued, no plant being available; the snagging operations make the natural depths of the stream available during the low-water season in which the snagging is done. The winter and the spring floods following bring other obstructions into the stream; hence snagging operations are needed every year.

Forsyth, Mo. (505 miles above the mouth), is the head of steamboat navigation. From its mouth to Jacksonport, 264 miles, the river is generally spoken of as being navigable at any time for boats of not over 3-foot draft. Between Jacksonport and Batesville, where Lock No. 1 of the upper White River improvements is located, the low-water channel depths are approximately 16 inches.

The range between extreme high water and extreme low water below Dam No. 1 at Batesville is 35.5 feet; at Jacksonport, 34.4 feet; at Clarendon, 32.5 feet; and at the mouth of the river 53.7 feet.

On page 1668 of the Annual Report of the Chief of Engineers for 1896 there is given the location of all the principal works built for the improvement of this river. Report of survey from Forsyth, Mo., to the mouth, with plans for improvement, is given in the Annual Report of the Chief of Engineers for 1888, page 1406.

The snagging operations this fiscal year consisted in operating the snag boat *Quapaw* three and one-half months and the snag boat *C. B. Reese* one and a half months between the mouth of the river and Lock No. 1, near Batesville, Ark. By these operations 771 snags were removed, 30 drifts broken, and 2,826 trees cut.

The balance available July 1, 1909, and the amount estimated as being needed during the fiscal year ending June 30, 1911, will be applied to maintenance and operation of snag boats.

Commercial statistics, year ending May 31.

Year.	Tons.	Value.	Year.	Tons.	Value.
1895	73,759	$2,494,377	1903	140,013	$882,225
1896	74,882	2,056,991	1904	198,498	1,021,778
1897	73,962	2,435,814	1905	134,588	770,689
1898	102,337	1,415,013	1906	100,063	766,138
1899	117,891	1,619,351	1907	127,812	880,659
1900	134,696	2,244,222	1908	161,246	962,508
1901	148,574	1,700,355	1909	134,200	671,230
1902	184,066	1,242,438			

Forest products made up the bulk of the commerce. Twenty-eight per cent of the commerce reported was rafted saw logs floated with the current.

July 1, 1908, balance unexpended	$18,031.87
Receipts from sales	17.60
Amount allotted from appropriation by river and harbor act approved March 3, 1909	16,000.00
	34,049.47
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	11,107.90

July 1, 1909, balance unexpended	$22,941.57
July 1, 1909, outstanding liabilities	618.22
July 1, 1909, balance available	22,323.35
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	17,500.00

CUMBERLAND RIVER ABOVE NASHVILLE, TENN.

This section extends from Nashville to the mouth of Rockcastle River, 357 miles. In its original condition it was considerably obstructed by rock reefs, ledges, snags, etc., which greatly impeded navigation between Nashville and Burnside (about 325 miles), while above Burnside the Smith shoals formed a serious obstruction to navigation at practically all stages.

The original scheme of improvement above Nashville, as modified and extended, contemplated open-channel work from Nashville, Tenn., to Cumberland Ford (Pineville, Ky.), 497 miles, at an estimated cost of $374,764, and was based on projects submitted January 20, 1871, and February 8, 1872.

The first appropriation, specifically applicable to the Cumberland River above Nashville, was made by the act of August 14, 1876.

This open-channel scheme of improvement, or old project, resulted in giving increased depths at several of the principal obstructions, thus securing a longer and safer period of navigation. Under this project and its modification appropriations aggregating $346,000 were made and expended.

The project for the canalization of the Cumberland River above Nashville, based on reports of an examination and survey in 1882 and 1883, was adopted by the river and harbor act of August 5, 1886.

This scheme of improvement provided for the construction of 22 locks and dams below Burnside, Ky., and 6 locks and dams at Smith shoals, above Burnside, the intention being to provide a complete system of lockage from Nashville, Tenn., to Rockcastle River, so as to afford a channel depth of 6 feet, the locks to be 52 feet wide and 280 feet long, with lifts varying from 10 to 12 feet, at an estimated cost of $8,500,000.

On February 16, 1905, the Board of Engineers for Rivers and Harbors reported on the project of canalization as follows:

> The Board is of the opinion that the regulation of the river and * * * the completion of Locks and Dams 3, 4, 5, 6, and 7 above Nashville, so as to carry the improvement of the river from its mouth to Carthage, Tenn., is worthy of being continued by the United States, but that the construction of the locks and dams proposed between Carthage and Burnside, except No. 21, now under contract, is not at present justified by the commerce involved.

The river and harbor act of March 2, 1907, adopted the modified project for completing the improvement in accordance with this report by providing for the completion of Locks and Dams Nos. 3, 4, 5, 6, and 7 at an additional expenditure of $550,000, thus reducing the cost of the project as modified to $2,769,000, increased in the report for 1908, page 1690, to $2,854,000. The act appropriated $150,000 and authorized continuing contracts in the further sum of $400,000 for completing the project. The entire amount so authorized has now been appropriated.

For the statement concerning the annulment of the contract for constructing Lock and Dam No. 21 see the Report of the Chief of Engineers for 1908, page 1689.

The district officer recommends that an additional sum of $85,000 be appropriated to finish the work at Lock 21, as experience shows that it will be impossible to build the dam and do the necessary work of bank protection and paving within the present estimate of cost. His recommendation is concurred in.

Attention is invited to the district officer's further recommendation in this connection, however, that no such appropriation be made for the completion of this work unless the town of Burnside, which is in the vicinity of the proposed lock and will derive the greatest benefit from the improvement, furnish adequate terminal facilities by reserving for all time, by appropriate legislative action, a portion of its water front, and devote it exclusively to the accommodation of river commerce upon such terms as will be reasonable and just to the public.

Under the project of canalization appropriations and allotments aggregating $2,779,000 have been made; $493.15 have been received from recoveries, sales, etc., making a total of $2,779,493.15. Of this amount about $42,036.95 is chargeable to maintenance, leaving $2,737,456.20 applicable to works of improvement. The total expenditures under this project to June 30, 1909, amount to $2,378,110.47, of which sum about $31,564.15 was applied to maintenance.

These expenditures have resulted in an improved channel way by the periodical removal of snags and other surface obstructions; the completion and operation of Lock and Dam No. 1 (2.5 miles below Nashville); Lock and Dam No. 2 (9 miles above Nashville); and Lock and Dam No. 3 (26 miles above Nashville); the completion of the masonry required for locks and abutments of dams Nos. 4, 5, 6, and 7 (44.7, 72, 89, and 106.6 miles, respectively) above Nashville; the purchase of sites for abutment at Lock No. 8 (125.2 miles above Nashville); and for Lock and Abutment No. 22 (320.2 miles above Nashville); the selection of sites for the locks of the Smith shoals system; the letting and partial execution of the contracts for the construction and erection of the gates for Locks 3 to 7, and for Lock 21; the partial construction of Lock No. 21; the purchase and delivery of the lumber for Dam No. 5; and contingencies pertaining to the entire improvement.

The Cumberland River is navigable usually from Nashville to Burnside, Ky., 325 miles, for steamboats drawing not more than 3 feet from four to six months of each year, and for boats of greater draft from two to three months. The fall is 223 feet, or about 8 inches per mile.

From Nashville to Caney Fork River (Carthage, 116 miles) the river is navigable for steamboats of 2½ feet draft from six to eight months, and for those of greater draft four or five months. Steamboats of light draft can ascend to Burkesville, 236 miles above Nashville, for from five to seven months and larger boats four or five months.

The head of navigation is Burnside, Ky., for steamers and other craft. This section is considered navigable for rafting and logging for about 35 miles above Burnside.

Lock No. 1 was placed in operation November 26, 1904. The completion of this lock affords a good harbor at Nashville, where a number of new boats and barges were put in commission as a result of this improvement.

Lock No. 2 was put in operation on October 9, 1907, and Lock No. 3 was placed in operation on October 15, 1908. The completion of these three locks gives a 6-foot navigation the year round for a distance of about 47 miles above Nashville.

The early completion of the work at Locks Nos. 4, 5, 6, and 7, where the more expensive masonry parts have already been built, is regarded of great importance, as this is necessary to make the improvement available and will provide a permanent channel for navigation from Nashville to Carthage and the Caney Fork River. When these locks are in operation the effect of the project on freight rates will be more fully apparent.

The expenditures during the past fiscal year were applied to the completion of placing Lock No. 3 in operation; erecting the lock gates under contract at Locks Nos. 4 and 5; partial construction of Dam No. 5; purchase and delivery of the materials preparatory to the construction of the guard walls at Locks Nos. 6 and 7; quarrying stone for dams; letting of the contract for the delivery of the timber for Dam No. 4; construction of two lock houses at Lock No. 3; construction of floating plant and temporary buildings for shops and quarters at Locks Nos. 6 and 7; construction of Lock No. 21 and contingencies pertaining to the entire improvement.

The amount expended for maintenance during the past fiscal year was applied to the purchase of material for a snag boat.

It is proposed to apply the amount estimated as a profitable expenditure in the fiscal year 1911 as follows: Eighty-five thousand dollars to the work of placing Lock No. 21 in operation, and $10,000 to maintenance of improvement. The funds are needed to make the improvement available for the needs of commerce and for maintaining the channel of the river in a navigable condition.

The commerce on the Cumberland River above Nashville for the calendar year 1908, as nearly as could be ascertained, aggregated 246,260 tons, having an estimated value of about $8,745,289; passengers carried, 8,635. The tonnage consisted mainly of timber and farm products and general merchandise.

For references to surveys see page 495, Annual Report of Chief of Engineers, 1906.

July 1, 1908, balance unexpended		$399,049.59
Amount allotted from appropriation by river and harbor act approved March 3, 1909		10,000.00
Amount appropriated by sundry civil act approved March 4, 1909		250,000.00
Cash allowance received from Underwood Typewriter Co		17.25
		659,066.84
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$257,469.88	
For maintenance of improvement	214.28	
		257,684.16
July 1, 1909, balance unexpended		401,382.68
July 1, 1909, outstanding liabilities		25,153.34
July 1, 1909, balance available		376,229.34

July 1, 1909, amount covered by uncompleted contracts		$43,488.70
Amount (estimated) required for completion of existing project		85,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, exclusive of the balance unexpended July 1, 1909:		
For works of improvement	[c] $85,000.00	
For maintenance of improvement	10,000.00	
		95,000.00

CUMBERLAND RIVER, BELOW NASHVILLE, TENN.

The Cumberland River rises in eastern Kentucky, on the western slope of the Cumberland Mountains, flows in a tortuous course of about 688 miles through eastern Kentucky, middle Tennessee, and western Kentucky, and discharges into the Ohio River near Smithland, Ky. From Burnside, Ky., the head of steamboat navigation, to Smithland, Ky., the distance is 518 miles by the river, 203 miles being in the State of Kentucky and 315 miles in the State of Tennessee.

Below Nashville (193 miles).—From 1830 to 1840 the legislatures of Tennessee and Kentucky made several appropriations for the improvement of the navigation of the Cumberland River, but little benefit to the general condition of the river seems to have been accomplished. The Cumberland Navigation Company was incorporated by the State of Tennessee in 1846 for improving the "navigation of the Cumberland River below the town of Nashville by means of a system of locks and dams," but nothing effective was done to carry out the proposed improvement.

In its original condition this section of the river was considerably obstructed by rocky ledges, conglomerate, gravel, and sand bars, snags, and other surface obstructions, on account of which navigation was rendered very uncertain.

From July 17, 1832, to July 7, 1838, Congress made five appropriations for improving the Cumberland River, Tennessee and Kentucky, aggregating $155,000, $20,000 of which was to be expended below Nashville and $135,000 on the river generally, but all the appropriations for the above period were expended below Nashville, to improve the worst localities.

Between 1838 and 1871 no appropriations for this river were made. The original project (open-channel work), which provided specifically for operations on this section, was adopted by the river and harbor act of March 3, 1871, based on project submitted January 20, 1871. The work proposed was as follows: To excavate the bars and rock ledges in order to get an additional depth of water; to contract the waterways in places in order to get the requisite depth; to remove snags and bowlders from the main channel; and to restrain tributary streams in well-determined channels at their junction with the river.

To increase the depth of water at the shoals in Kentucky Chute at the junction of the Cumberland with the Ohio River, a Board of Engineer officers in 1888 recommended the construction of a dike near Smithland, Ky., at an estimated cost of $129,600. The river and harbor act of September 19, 1890, allotted $30,000 from the appropriation for improving Cumberland River below Nashville, to be expended in improving the mouth of the river, as recommended.

[c] An appropriation of this amount is recommended by the district officer and the Chief of Engineers, subject to certain important conditions set forth above.

Appropriations aggregating $305,000 were made and expended, thus completing the above project. The expenditures under the old project have resulted in lengthening the season of navigation by giving an increased depth at low water combined with greater security in the passage of obstructions.

The present project for improving the Cumberland River below Nashville was adopted July 13, 1892, by the river and harbor act of that date. It contemplates the extension of the lock and dam system of the upper river over a considerable portion of the river below Nashville by the construction of 7 locks and dams, commencing at or near Harpeth shoal (Lock A) and ending at Big Eddy shoal (Lock G); the locks to be 52 feet wide and 280 feet long, with lifts varying from 8½ to 11½ feet and aggregating some 70 feet. The project also includes the improvement of the Kentucky Chute, at the mouth of the river, as recommended by the Board of Engineer officers in 1888, the necessary channel work below Lock G, and the removal of surface obstructions, snags, logs, etc., below Nashville. The total estimated cost of the entire improvement is $1,964,500. (Annual Report of the Chief of Engineers for 1894, p. 1806.)

Under this project appropriations and allotments aggregating $450,000, which, with receipts from sales and other receipts, $986.30, makes a total of $450,986.30.

The total expenditures under this project to June 30, 1909, amount to $440,745.61, of which sum about $20,897.60 have been applied to maintenance.

These expenditures have resulted in the periodical removal of snags and other surface obstructions from the navigable channel, the protection of the bank of a part of Cumberland Island in Kentucky Chute at the mouth of the river, and the completion and placing in operation of Lock A, November 26, 1904, whereby a 6-foot navigation has been afforded all year round for a distance of 38.8 miles above the lock. The season of profitable navigation from the Ohio River to Nashville has been prolonged by forty-five to ninety days, depending on the stage of water, making it now average eight months annually. Lock A is 41.4 miles below Nashville.

The Cumberland River below Nashville is usually navigable for all steamboats plying on it for six months in each year; for boats not drawing over 3 feet, from six to eight months, and for boats drawing 16 inches or less, the whole year. General navigation, however, is practically closed for several months each year during low water. As a general rule, when the stage is below 2½ feet, navigation is closed; between 2½ feet and 5 feet, it is uncertain, and above 5 feet, good. A table is given on page 390 of the Annual Report of the Chief of Engineers for 1902, showing the stages at Burnside, Carthage, Nashville, and Clarksville for the years 1898–1902.

No work of improvement was carried on during the past fiscal year.

The funds expended were applied to the cost of the survey for locks and dams authorized by the act of March 2, 1907.

A preliminary report of the survey ordered by the act of March 2, 1907, is printed in House Document No. 758, Sixtieth Congress, first session. The final report is printed in House Document No. 1481, Sixtieth Congress, second session.

In these reports the district officer recommends the further improvement of the Cumberland River below Nashville by the con-

struction of the necessary locks and dams. This recommendation was concurred in by the division engineer, Board of Engineers for Rivers and Harbors, and the Chief of Engineers.

Attention is invited to the recommendation of the district officer in the appendix to this report that the necessary funds for the commencement of the work be appropriated at the earliest date practicable. This recommendation is concurred in.

The reported commerce for the calendar year 1908 was 259,734 tons, having an estimated value of about $4,621,197; passengers carried, 33,000. The tonnage consisted principally of timber and farm products, and general merchandise.

It is reported that the Tennessee Central Railroad, which parallels the Cumberland River from Nashville to Clarksville, had rates in force before the completion of Lock and Dam A of from 18 to 26 cents per 100 pounds, and since this lock was put in operation these rates have been reduced above the lock to from 6 cents to 12 cents per 100 pounds.

The quantity of grain handled by the local steamboats has increased considerably since the completion of Lock A, and a new line of steamboats, the Tyner Line, has been operating during the boating season.

It appears from reliable information that the cost of transporting grain by river to Nashville is about 8 cents per 100 pounds from points below Evansville on the Ohio River, while it is 15 cents per 100 pounds by way of river to Henderson or Uniontown, Ky., and thence by rail to Nashville, or a saving of about 7 cents per 100 pounds by all-river transportation. Within the past year freight rates by rail have advanced 12½ to 20 per cent on every class of merchandise going south out of Nashville, while into Nashville it appears that the tariff has not been advanced. There is little doubt that the competition offered by the Cumberland River, even in its present condition, is the cause of the favorable rates into Nashville.

The amount estimated as a profitable expenditure in the fiscal year ending June 30, 1911, will be applied to necessary maintenance. The funds are needed for maintaining the river in a navigable condition. No estimate is submitted for further work on the old or existing project for improvement by locks and dams pending action by Congress on the new plan for slack-water improvement referred to above.

July 1, 1908, balance unexpended	$8,731.44
Cash allowance received from Underwood Typewriter Company	
Amount allotted from appropriation by river and harbor act approved March 3, 1909	10,000.00
	18,743.69
June 30, 1909, amount expended during fiscal year, for survey	8,503.00
July 1, 1909, balance unexpended	10,240.69
July 1, 1909, outstanding liabilities	6.95
July 1, 1909, balance available	10,233.74
Amount (estimated) required for completion of existing project	1,549,818.81
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

Reports on recent surveys are printed in House Documents No. 758, Sixtieth Congress, first sesison, and No. 1481, Sixtieth Congress, second session. The report of the Board of Engineers in the former document is as follows:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., March 9, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

Section 1 of the act of March 2, 1907, contains the following:

"Improving Cumberland River, Tennessee and Kentucky, below Nashville; The Secretary of War may cause a survey to be made with a view to the improvement by locks and dams of that portion of the river heretofore surveyed in which no locks and dams have been constructed."

This survey is for the purpose of locating lock and dam sites on the Cumberland River between its mouth and Lock A, which is 41 miles below Nashville. Survey work, which has been in progress, was interrupted by high water, and as it will be some time before it can be resumed the within report has been submitted covering that part of the river already surveyed.

Sites for Locks and Dams B and C have been located, and the sites for Lock D explored, but not finally accepted. The cost of Locks B and C, as estimated by the district officer, is, respectively, $562,026 and $696,267.60. There will be required for the completion of the system below Nashville three or four locks in addition to Locks B and C, depending upon the lift adopted.

In a report submitted by the Board under date of February 26, 1906, in compliance with a resolution of the Committee on Rivers and Harbors of the House of Representatives, published in House Document No. 699, Fifty-ninth Congress, first session, "with a view to ascertaining whether improvements should at present be undertaken in addition to those for which appropriations have already been made," the Board described in considerable detail the economic features involved in the improvement of the Cumberland River, and in conclusion stated—"The Board is of opinion that the regulation of the river and the construction of the six locks and dams of the system below Nashville * * * is worthy of being continued by the United States."

Neither physical nor commercial conditions appear to have changed since the report of the Board just referred to, and it seems unnecessary, therefore, to go further into the subject at this time than to say that both the district officer and the division engineer express views which accord with those of the Board, that Locks and Dams B and C are in the logical order of the work to be done, and that the board recommends for favorable consideration the project proposed by the district officer.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

Following is the letter of the Chief of Engineers submitting the report contained in House Document No. 1481, Sixtieth Congress, second session:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, February 24, 1909.

SIR: Referring to letter from this office, dated March 10, 1908, and in further compliance with the law, I now have the honor to submit herewith for transmission to Congress a final report dated January 18, 1909, by Maj. Wm. W. Harts, Corps of Engineers, on survey authorized by item in section 1 of the river and harbor act approved March 2, 1907, as follows:

"Improving Cumberland River, Tennessee and Kentucky, below Nashville: The Secretary of War may cause a survey to be made with a view to the improvement by locks and dams of that portion of the river heretofore surveyed in which no locks and dams have been constructed."

In the section of the Cumberland River below Nashville, Tenn., one lock and dam (A) has already been constructed, and in the report transmitted with office letter of March 10, 1908, and published in House Document No. 758, Sixtieth Congress, first session, sites were indicated and estimates submitted for the next two locks and dams (B and C) in the series beginning at Nashville and extending downstream.

As a result of his further investigation the local officer now proposes the construction of three more locks and dams (D, E, and F) to complete the system, or six in all, together with the necessary dredging between the lowest lock and the mouth of the river to afford a channel 150 feet wide and 6 feet deep at low water. The cost of these three locks and dams, and the dredging proposed, is estimated at $1,905,688.80, which, together with the estimates heretofore submitted for Locks and Dams B ($562,926) and C ($696,267.60), makes a total of $3,164,882.40 for the work remaining to be done to complete the project for 6-foot navigation on the river below Nashville.

I concur in the opinion of the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors that Cumberland River below Nashville is worthy of improvement in the manner proposed.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

The increased use of the river in recent years is shown by the following table of statistics for 1896–1906, the figures being those given in the Annual Reports of the Chief of Engineers:

Year.	Tonnage.	Value.	Passengers.
Fiscal year:			
1896	40,676	$1,978,533	8,120
1897	32,703	1,512,637	4,340
1898	71,674	7,788,530	16,085
Calendar year:			
1898	120,232	5,711,998	31,200
1899	263,608	4,771,049	11,900
1900	407,088	5,140,616	11,000
1901	255,557	3,694,428	12,000
1902	283,531	7,347,047	25,000
1903	297,438	3,888,305	8,000
1904	275,371	3,034,000	7,550
1905	253,480	5,060,451	7,700
1906	223,899	3,678,420	6,000

OBION AND FORKED DEER RIVERS, TENNESSEE.

The river and harbor act of June 13, 1902, authorized the joint improvement of the Obion and Forked Deer rivers.

(*a*) *Obion River.*—This stream is situated in northwestern Tennessee. It is formed by the junction of its North and South forks about 6 miles northeast of Obion, which is considered the head of navigation for steamers and other craft, and it flows in a general southwesterly direction about 75 miles, entering the Mississippi River some 5 miles below the Missouri and Arkansas state line. It is probable that rafting and logging are feasible as far up as 25 miles above Obion.

In its original condition the obstructions on this river were almost wholly drift, snags, and overhanging trees, which made navigation difficult and uncertain.

The original project was based on a survey made in 1891, and was adopted by the river and harbor act of July 13, 1892. The scope of the work was to obtain 3-foot navigation at low water by means of open-channel work, at an estimated cost of $50,000. After an expenditure of $15,795.01 this project was modified in June, 1897, to one for maintenance, so as to keep the river free from such obstructions as would prevent navigation at medium and high stages, at an estimated annual cost of $2,500.

In 1903 the annual expenditure recommended for maintenance of the Obion and Forked Deer Rivers combined was reduced from $4,500 to $2,250. (See Annual Report for 1904, p. 2351.)

Appropriations and allotments aggregating $29,400 have been made for the Obion River, of which $28,395.62 have been expended under the present project to June 30, 1909.

No work was done during the past fiscal year. The funds expended were applied to maintenance of the floating plant.

The expenditures have resulted in temporary improvements to the channel, lessening the dangers to navigation at medium and higher stages from Obion, Tenn., to the mouth of the river. The navigability of the Obion River depends largely on the stage of water in the Mississippi. Navigation is not practicable at low stages.

For the calendar year ending December 31, 1908, the reported commerce on this stream amounted to 8,684 tons, having an estimated value of about $51,415, consisting almost wholly of timber products; passengers carried, 100.

For additional details of the Obion River, see the account of its survey in the Annual Report of 1891, page 2992. The effect of the improvement on freight rates is not believed to be important and can not readily be ascertained.

The district officer expresses the opinion, for reasons stated in his report, that further appropriations under this project are not warranted.

July 1, 1908, balance unexpended	$1,213.21
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	208.83
July 1, 1909, balance unexpended	1,004.38
July 1, 1909, outstanding liabilities	13.00
July 1, 1909, balance available	991.38

(*b*) *Forked Deer River.*—This stream is formed by the junction of its North and South forks about 8 miles southwest of Dyersburg, and flows thence in a general southwesterly direction about 21 miles, entering the Obion River about 3½ miles from the Mississippi. Dyersburg is considered the head of navigation on the North Fork. Jackson, Tenn., 95½ miles above the mouth, was formerly considered the head of navigation on the South Fork, but in recent years navigation appears to have been limited to the lower portion of this stream. It is probable that rafting and logging can be carried on to a distance of 25 miles above Dyersburg.

In their original condition the main stream and its branches, the North Fork and South Fork, were greatly obstructed by snags and drift. The original project may be said to have been adopted by the river and harbor act of August 2, 1882, and was based on a report of an examination of South Fork, dated December 16, 1880. This project was subsequently modified by extension to include the North Fork and main stream until appropriations aggregating $25,000 were made and expended. The operations proposed were open-channel work, by which it was sought to maintain a satisfactory channel all the year round. This project was set aside in view of the fact that the result aimed at could not be accomplished by this method.

The present project for maintenance, based on the provisions of the act of March 3, 1899, provided for the removal of surface obstructions

from the Forked Deer River and its navigable branches (North and South forks), at an estimated annual cost of $2,000. In 1903 the annual expenditure recommended for maintenance of both the Obion and Forked Deer rivers was reduced from $4,500 to $2,250. (See Annual Report for 1904, p. 2351.) Under this project appropriations and allotments aggregating $12,600 have been made, of which $11,766.37 has been expended to June 30, 1909. The expenditures have resulted in temporary improvements to the channel, lessening the dangers to navigation at medium and higher stages. The navigability of the Forked Deer River depends largely upon the stage of water in the Mississippi. Navigation is not practicable at low stages.

No work was done during the past fiscal year. The funds expended were applied to the maintenance of the floating plant.

For the calendar year ending December 31, 1908, the reported commerce on this stream amounted to 16,165 tons, having an estimated value of about $35,150, and consisting almost wholly of timber products. Passengers carried, 300.

For references to sundry examinations and surveys of the Obion and Forked Deer rivers, see the Report of the Chief of Engineers for 1908, page 553. For the report of the survey of the South Fork of the Forked Deer River dated January 22, 1908, see House Document No. 945, Sixtieth Congress, first session.

The effect of the improvement on freight rates is not believed to be important and can not readily be ascertained.

This river has been combined with the Obion in the work of improvement, and they have ordinarily been considered together in making appropriations of funds.

The district officer expresses the opinion, for reasons stated in his report on Obion River, that further appropriations under this project are not warranted.

July 1, 1908, balance unexpended	$985.17
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	151.54
July 1, 1909, balance unexpended	833.63
July 1, 1909, outstanding liabilities	11.50
July 1, 1909, balance available	822.13

CONSOLIDATED.

July 1, 1908, balance unexpended	2,198.38
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	360.37
July 1, 1909, balance unexpended	1,838.01
July 1, 1909, outstanding liabilities	24.50
July 1, 1909, balance available	1,813.51

CLINCH AND HIWASSEE RIVERS, TENNESSEE.

(*a*) *Clinch River.*—This river rises in the Cumberland Mountains in Virginia, and, after following a southwesterly course, empties into the Tennessee River at Kingston, 104 miles above Chattanooga. It drains an area of about 5,000 square miles. Its average slope below Clinton (60 miles from the mouth) is about 1.3 feet per mile. The

ordinary low-water discharge at Clinton is about 900 cubic feet per second. There are about 193 miles of the river in the State of Tennessee.

In its original condition the channel was obstructed by rock reefs, sand and gravel bars, bowlders, snags, and overhanging trees.

The present project, adopted in 1880, provides for channel excavation, removing surface obstructions, and the construction of wing dams and training walls, so as to secure a navigable channel 2 feet in depth at ordinary low water from the mouth of the river to Clinton, about 60 miles, and of 1.5 feet in depth from Clinton to Haynes (or Walkers) Ferry, about 66 miles. From Haynes Ferry to the state line, a distance of about 67 miles, it is proposed simply to remove the loose rock and bowlders, reduce the rock ledges, and remove snags, overhanging trees, and similar obstructions, so as to assist raft and flatboat navigation at the stages at which the river is ordinarily used.

The sums thus far appropriated and allotted for this stream amount to $54,825.43, and $1.10 additional has been received from sales, making the total receipts $54,826.53.

The amount expended to June 30, 1909, was $54,401.12. This has been applied to reducing reefs, removing surface obstructions, and building wing dams and training walls, whereby the use of the river has been rendered practicable at stages 2 to 3 feet lower than before the improvement was begun. The expenditures of the past fiscal year were in connection with a public hearing and the inspection of certain bridges.

The town of Clinton has been reached by small steamboats, and is regarded as the practicable limit of steamboat navigation. Rafts are transported from points at least as far upstream as Speers Ferry, Va., 201 miles from the mouth.

The commerce reported on the Clinch River for the calendar year 1908 consisted of 64,410 tons of logs rafted, valued at about $386,460, and about 900 tons of farm products carried between Harriman, on the Emory River, and Tennessee River points, a distance of 4.5 miles on the Clinch. Statistics of the traffic arriving at and departing from Kingston, Tenn., were not compiled separately from the commerce of the Tennessee River, as this town is situated so near the mouth of the Clinch as to make it virtually a Tennessee River port.

For reasons given in his report the district officer recommends the suspension of appropriations for this stream for the present.

For survey of this river see Annual Report of the Chief of Engineers for 1901, page 2542.

There is no information available indicating the extent to which freight rates are affected by this improvement. It seems safe to say that it will necessarily be slight until the time arrives when changed conditions shall have warranted the adoption of a plan for the radical improvement of this stream.

July 1, 1908, balance unexpended	$527.62
June 30, 1909, amount expended during fiscal year, for works of improvement	102.21
July 1, 1909, balance unexpended	425.41
July 1, 1909, outstanding liabilities	28.84
July 1, 1909, balance available	396.57

(*b*) *Hiwassee River.*—The Hiwassee River rises in the mountains of western North Carolina and northern Georgia, flows in a northwesterly direction, and enters the Tennessee River about 35 miles above Chattanooga. Its largest tributary is the Ocoee River, which enters it from the south about 35 miles from its mouth. The Hiwassee drains an area of about 2,725 square miles. Its average slope below the Ocoee is about 0.93 foot per mile. The low-water discharge at the mouth of the Ocoee is given as about 950 cubic feet per second.

On examination, made in 1874, the channel was found to be obstructed by rock reefs, gravel bars, shags, and overhanging trees.

The original project of improvement, based on the examination of 1874, was for a navigable channel 40 feet wide and 2 feet deep at ordinary low water to Savannah Ford, about 41.6 miles from the mouth of the river, to be secured by excavation of rock reefs and gravel bars and construction of wing dams. Expenditures under this project amounted to $36,427.07.

The present project, based on a survey made in 1899, contemplates the development of a channel of not less than 116 feet width and 30 inches mean depth between the mouth of the river and the mouth of the Ocoee River by use of spur dikes, training walls and submerged sills, bank protection, and dredging, at an estimated cost of $71,125. There were sixteen shoals having less than the desired depth at low water.

This project was adopted by the river and harbor act of June 13, 1902.

Under the present project $74,855.33 has been received from appropriations and allotments and $8.23 from sales, making a total of $74,863.56.

The amount expended on the present project to June 30, 1909, was $67,044.18. This has been applied to maintenance of the navigable channel and to work of improvement at Blackbird, Ackerman, Hogwallow, Rogers, Mathews, Agency, and Bunker Hill shoals, the most serious obstructions between Charleston and the mouth. In the past fiscal year channel work was carried on at each of these localities, mainly by dike construction and dredging. A new steamboat for this work, built under contract at a cost of $10,000, was launched in August, 1908.

The maximum draft that can be carried over the shoalest place at mean low water is about 2 feet. The extreme flood oscillation at Charleston, 19 miles above the mouth, is about 32 feet, but ordinary floods do not exceed about 15 to 18 feet. Small boats of about 100 tons capacity can navigate the river eight months in the year. Savannah Ford, 7 miles above the mouth of the Ocoee River, has at times been reached by steamboats, and is usually regarded as the head of navigation; although at present steamboat traffic does not extend above Charleston. Rafting and logging are not considered practicable above Savannah Ford.

The commerce on the Hiwassee River reported for the calendar year 1908 amounted to about 6,330 tons, valued at about $176,160. It consisted principally of farm products and general merchandise.

For report of survey see Annual Report of the Chief of Engineers for 1901, page 2458.

There is no information available indicating the extent to which freight rates will be affected by this improvement. It will probably be slight.

All the funds called for in the estimate of the present project have been appropriated. In order to maintain the improvement in an effective manner $10,000 should be appropriated biennially for maintenance, and this amount has been estimated for as a profitable expenditure in the fiscal year 1911.

July 1, 1908, balance unexpended	$39,263.95
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	44,263.95
June 30, 1909, amount expended during fiscal year, for works of improvement	36,444.57
July 1, 1909, balance unexpended	7,819.38
July 1, 1909, outstanding liabilities	2,022.51
July 1, 1909, balance available	5,796.87
Amount that can be profitably expended in fiscal year, ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

Report on a survey of Clinch River is printed in House Document No. 75, Fifty-sixth Congress, second session, and also in Report of Chief of Engineers, 1901, page 2542.

The Chief of Engineers, in submitting the report under date of November 27, 1900, says:

I have now the honor to submit herewith copy of final report on the survey, dated August 3, 1909, by Major Kingman, with accompanying maps.

It is the opinion of the local officer, concurred in by Col. Henry M. Robert, Corps of Engineers, division engineer, that improvement of the river by means of locks and dams is the most certain and satisfactory method, and the project presented contemplates construction of 11 locks and dams, at an estimated cost of $1,460,000, to provide an extreme low-water depth of 4 feet from the mouth up to Coal Creek. This will also secure the improvement of Emory River up to Harriman, Tenn.

In the opinion of Colonel Robert, the improvement is worthy of being undertaken by the General Government as a part of a system including the Tennessee River to its mouth.

FRENCH BROAD AND LITTLE PIGEON RIVERS, TENNESSEE.

The French Broad River is one of the largest tributaries of the Tennessee. It rises in North Carolina, flows in a generally northwesterly direction, and finally unites with the Holston River in the State of Tennessee, about 4.5 miles above Knoxville, to form the Tennessee River. It has a drainage area of about 5,600 square miles. Leadvale, Tenn., about 70 miles above the mouth, has generally been considered the head of navigation in Tennessee, and it is not believed that rafting or logging is practicable to any great extent above this point. An isolated portion of the river in North Carolina, between Brevard and Asheville, was under improvement for several years from 1877 to 1882, and $43,000 was expended in removing obstructing bowlders, fish traps, and snags, and in dredging and constructing wing dams at Cherokee, Big Buck, and other shoals.

In its original condition the river was obstructed by rock reefs, sand and gravel bars, and by bowlders, snags, and overhanging trees, and numerous islands in the river divided the water and diminished the depth in the navigable channels. There were 41 shoals obstructing navigation below Leadvale. The average slope below Leadvale is about 2.3 feet per mile, and the low-water discharge at Leadvale is reported as about 2,000 cubic feet per second.

The Little Pigeon River is formed by the junction of its east and south forks at Sevierville, Tenn., and flows in a northerly direction for about 5 miles, emptying into the French Broad about 29 miles above its mouth. The Little Pigeon is navigable at ordinary stages only about 2 miles above its mouth (to Catlettsburg), and thus practically amounts to an additional landing on the French Broad. In its original condition this portion of the river was obstructed by a bar at its mouth.

The present project, adopted June 14, 1880, provides for open-river work on the French Broad to secure a navigable channel at low water from the mouth to Leadvale sufficient to permit the passage of boats drawing about 2.5 feet, at an estimated cost of $150,000, and for the removal of the bar at the mouth of the Little Pigeon.

To June 30, 1909, $147,000 had been appropriated and allotted for this improvement in both North Carolina and Tennessee, and $503.01 had been received from other sources, making an aggregate of $147,503.01.

The amount expended to June 30, 1909, for work in the State of Tennessee was $98,637.91, of which $8,085.16 was for maintenance. This expenditure has been applied to the improvement of 15 shoal places in the French Broad, the maintenance of the navigable channel, and the removal of the bar at the mouth of the Little Pigeon.

No active operations were carried on during the fiscal year, owing to insufficient funds. The expenditures were in connection with preparing and equipping the plant required for the coming season's work of maintenance.

The maximum draft that can be carried over the shoalest place at mean low water is probably about 18 inches. The extreme flood oscillation is about 30 feet, ordinary floods having a range of about 10 to 15 feet. Steamboats rarely go above Dandridge, 46.5 miles above the mouth, and all the improvements are below this place.

The commerce carried on this river during the calendar year 1908 amounted to about 26,930 tons, valued at about $397,360.

For details of the French Broad see the report of survey in the Annual Report of the Chief of Engineers for 1900, page 3018. An examination of the Little Pigeon is reported in the Annual Report for 1891, page 2287.

The direction of traffic on these streams is not parallel to rail lines. The effect of the improvement on railroad rates, therefore, would be indeterminate, though doubtless important.

The district officer recommends, in view of the commercial importance of the French Broad River, that a biennial appropriation of $10,000 be made for maintenance of the improvement. His recommendation is concurred in. It is also recommended that an appropriation of $18,000 for works of improvement be made for the fiscal

year 1911, the work proposed being for the extension of benefits already obtained under the existing project.

July 1, 1908, balance unexpended	$3,177.52
Received from sales	1.05
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	8,178.57
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	2,313.47
July 1, 1909, balance unexpended	5,865.10
July 1, 1909, outstanding liabilities	175.68
July 1, 1909, balance available	5,689.42
Amount (estimated) required for completion of existing project	61,515.64
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	28,000.00

TENNESSEE RIVER SYSTEM.

The Tennessee River is 652 miles long. It is formed by the junction of the French Broad and Holston rivers, 4.5 miles above Knoxville and 188 miles above Chattanooga, and flows into the Ohio at Paducah, 464 miles below Chattanooga. Together with its principal tributaries it forms a system of internal waterways capable of being navigated more than 1,300 miles by steamboats. In addition to this, its tributaries are still further navigable by rafts and flatboats for a distance of more than 1,000 miles, thus making a system of navigable waters about 2,350 miles in length, with a drainage area of about 44,000 square miles.

The river is navigable the entire year from the mouth to Riverton, Ala. Just above Riverton a lateral canal about 8 miles long is now under construction past the Colbert and Bee Tree shoals, and the Muscle Shoals Canal now surmounts the Big Muscle and Elk River shoals.

Under the act of April 26, 1904, as amended by act of January 7, 1905, a lock and dam to be built mainly by private parties are projected at Hales bar, designed to form a pool extending 33 miles upstream to Chattanooga.

Local boat lines have headquarters at the principal towns along the river. There is no through traffic covering the entire length of the river, the longest regular boat service being found between Chattanooga and Paducah when the stage of water permits.

The amount so far appropriated and allotted for the Tennessee River and the canals thereon is $8,541,337.15; amount received from other sources, $2,461.95, making the total received $8,543,799.10. Of this the sum of $1,122,882.26 has been allotted for operating, care, and repair of the Muscle Shoals Canal from November, 1890, when it was opened to navigation, to June 30, 1909.

Freight rates are said to be already considerably lowered by this project, but there is no information available indicating to what extent they will be affected by its completion.

1. Tennessee River.—The improvement has been carried on in three sections under separate appropriations.

(*a*) *Above Chattanooga, Tenn. (188 miles).*—In its original condition this part of the river was obstructed by rock reefs, bowlders, gravel bars, and snags. The depth of water on the bars varied from 10 to 30 inches at low water, and in some places the current was as great as 6 miles an hour. The average slope is 0.956 foot per mile, with average low-water discharge varying from about 3,000 cubic feet per second at Knoxville to about 6,000 cubic feet per second at Chattanooga.

The present project, adopted by Congress in act of August 18, 1894, is to obtain by training walls, wing dams, and dredging a low-water channel 3 feet deep from Chattanooga to the mouth of the French Broad River, at an estimated cost of $650,000. Up to June 30, 1895, the sum of $328,255.83 had been expended under a previous project, and there remained 55 obstructions having less than 3 feet depth at low water. A revision of the estimate in 1907, on a basis of present unit prices, places the cost of the existing project at $1,709,000.

Appropriations and allotments under the present project amount to $352,014.63, and the receipts from sales, etc., have been $155.70; making a total of $352,170.33. The total amount expended under the present project to June 30, 1909, is $307,841.29, including $13,915.16 for maintenance.

Operations in recent years have been mainly concentrated at the formidable series of obstructions extending from Caney Creek shoals (about 98 miles above Chattanooga) downstream for a distance of about 8 miles. The projected works in that vicinity are well advanced toward completion, and a marked increase in channel depths has been obtained.

The work done in the past fiscal year comprised dredging and dike construction at Caney Creek shoals and dike construction at Little River shoals (12 miles below Knoxville). Operations were suspended in October, owing to the exhaustion of funds. In January, 1909, under an allotment made for the purpose, some work was undertaken at the latter place with a view to the reduction of objectionable current velocities due to the incomplete stage of the improvement. The funds expended for maintenance during the fiscal year were applied to this emergency work at Little River shoals and to the construction and repair of floating plant needed in the work of preserving the navigable condition of the channel.

The new wooden-hull steam tender *Chilhowee*, built under contract at a cost of $10,000, was launched in August, 1908.

The maximum draft that can be carried at mean low water over the shoalest place in this section is about 18 inches. The extreme flood oscillations range from about 40.5 feet at Knoxville to about 58 feet at Chattanooga.

The commerce reported on this portion of the river during the calendar year 1908 amounted to about 621,500 tons, valued at about $3,187,620, the principal items in order of value being marble, general merchandise, logs, and grain.

A map of this section of the river is printed in the Annual Report of the Chief of Engineers for 1876, page 710, and an account of its survey in the report of 1893, page 2333.

It is proposed to apply the amount given as a profitable expenditure in the fiscal year 1911 to maintaining the navigable waterway by the removal of minor channel obstructions and the repair of exist-

ing works of regulation, and to continuing improvement under the existing project for the purpose of extending the benefits already secured.

No active operations were carried on in the Little Tennessee River during the fiscal year. The total expenditures for its improvement up to June 30, 1909, amount to $5,510.09. Owing to the slight use made of this tributary, it is believed that further allotments from appropriations for the upper Tennessee River should not be made for it for several years, and no sum is therefore given as a profitable expenditure in the fiscal year 1911.

TENNESSEE RIVER ABOVE CHATTANOOGA.

July 1, 1908, balance unexpended		$35,049.41
Received from sales		2.85
Amount allotted from appropriation by river and harbor act approved March 3, 1909		50,000.00
Allotment from emergency act of March 2, 1907		1,270.46
		86,322.72
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$35,049.41	
For maintenance of improvement	6,944.27	
		41,993.68
July 1, 1909, balance unexpended		44,329.04
July 1, 1909, outstanding liabilities		2,461.29
July 1, 1909, balance available		41,867.75
Amount (estimated) required for completion of existing project		1,080,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		160,000.00

LITTLE TENNESSEE RIVER.

July 1, 1908, balance unexpended	$1,489.91
July 1, 1909, balance unexpended	1,489.91

(*b*) *Chattanooga, Tenn., to Riverton, Ala.* (*238 miles*).—In its original condition the channel from Chattanooga to Browns Ferry was obstructed by bars, bowlders, reefs, and rocky projections. Navigation was possible during six to nine months annually. Between Browns Ferry and Florence were the Muscle shoals obstructions, which could be crossed only at unusually high water. Between Florence and Riverton the Colbert and Bee Tree shoals prevented navigation for six months in the year.

The average slope is 1.5 feet per mile from Chattanooga to Scott Point (17.5 miles), thence 0.4 foot per mile to head of Muscle Shoals Canal (158 miles), thence 2.73 feet per mile to Riverton (62.5 miles), with average low-water discharge varying from about 6,000 cubic feet per second at Chattanooga to about 10,000 cubic feet per second at Riverton.

Under a former project the Muscle shoals section was improved, at a cost of $3,191,726.50, by some channel work at Little Muscle shoals and by the construction of a lateral canal in two divisions, one on the left bank about 3.5 miles long, with 2 locks, around the Elk River shoals, and the other on the right bank, about 14.5 miles long, with 9 locks, around the Big Muscle shoals. This work was done mainly from 1875 to 1890, under a project adopted originally in 1868.

Expenditures aggregating $595,532.74 have been made in the improvement of the open river at various localities between Chattanooga and Riverton under a former project, dating back to 1868, which contemplated securing a least depth of 3 feet at low water in the improved channels.

The existing projects for the improvement of this section are three in number. The first authorizes the construction by private parties of a lock and dam at Hales bar, about 33 miles below Chattanooga, which will form a pool extending above Chattanooga with a depth of at least 6 feet at low water, the parties doing the work being granted the use of the water power produced by the dam for a period of ninety-nine years. The United States is to prepare the plans, supervise the construction, and provide the gates, valves, operating machinery, and other appurtenances of the lock, at a total cost now estimated at $214,720. The project was adopted by act of April 26, 1904, amended (as to location of the work) by act of January 7, 1905.

The second project, adopted by act of March 2, 1907, provides for open-channel work to secure a depth of 5 feet at low water (in accordance with project submitted in H. Doc. No. 50, 57th Cong., 1st sess.) from Scott Point to Lock A, covering the stretch of 145 miles between Hales bar and the Muscle Shoals Canal, the revised estimate placing the cost of the work at $1,231,000.

The third project provides for the improvement of Colbert and Bee Tree shoals, near the downstream limit of this section, by the construction of a lateral canal about 8 miles long, with one lock of about 26 feet lift, at an estimated cost of $2,847,009.70. The original project was approved by the Secretary of War on November 28, 1890, and its last modification on June 12, 1905.

The appropriations and allotments under the present projects for the improvement of this section aggregate $2,547,644.24, and in addition the sum of $550.97 has been received from other sources, making a total of $2,548,195.21, of which the sum of $2,213,759.36 has been expended to June 30, 1909.

These expenditures have resulted in the preparation of plans for the Hales Bar lock and dam, the purchase of the metal work to be incorporated in the lock masonry, the letting of the contracts for the construction and erection of the upper and lower lock gates, the construction of a quarter boat for the United States inspecting force, and the supervision of the entire work, at a total cost of $47,283.80; in the partial improvement of the open-river channel at various points between Chattanooga and Riverton, notably at Allens bar, and the construction of floating plant needed to carry on advantageously the work of open-river regulation, at a cost of $108,404.96, including $3,048.70 for maintenance; and in the partial construction of the Colbert Shoals Canal, including the completion of the masonry of the lock, the construction of the concrete river wall, the excavation of about 90 per cent of the canal prism, the letting of a contract for the upper and lower lock gates, the erection of the lock houses, and the carrying out of minor incidental work by hired labor, at a total cost of $2,058,070.60.

The Muscle Shoals Canal provides a permanent depth of 5 feet, except in its approaches, where additional work will be required to secure this depth at low water, the improvement never having been fully completed at these points.

The maximum draft that can be carried at mean low water over the shoalest place between Chattanooga and Riverton is about 2 feet. The extreme flood oscillations range from about 69 feet at the Suck, 12 miles below Chattanooga, to about 10 feet at Lock No. 4 of the Muscle Shoals Canal.

The improvements at Hales bar and Colbert shoals will not be available for navigation until the works are completed.

At Hales bar the expenditures during the past fiscal year were applied to the letting of a contract for the lower gates, to the construction of a quarter boat for the United States inspectors, and to the cost of supervising the contract work of building the lock and dam. The concrete work is about 20 per cent completed, and about 35 per cent of the rock excavation and 68 per cent of the earth excavation had been accomplished up to the close of the fiscal year. In the annual report for 1908 (p. 564) the additional sum of $101,750 was estimated to be required for the completion of the work with which the United States is chargeable in connection with this improvement. The river and harbor act of March 3, 1909, carried an authorization of one-half of this amount, but no part thereof has yet been appropriated.

The funds expended during the fiscal year for open-channel work between Chattanooga and Riverton were applied to dredging at Allens bar, a serious obstruction between Hobbs Island and Guntersville, to dike construction at Chunn bar, and to the construction and repair of floating plant. Proposals were solicited for furnishing the machinery and fittings for a dipper dredge to be employed in this section of the river. Four bids were received, and the contract was awarded in the sum of $19,850.

In the appendix to this report the district officer gives his reasons for recommending an increased appropriation for open-channel work. His recommendation is concurred in.

The principal work done at Colbert shoals in the past fiscal year comprised excavation in the lower portion of the canal prism (three-fourths of the work that remained to be done having been accomplished), the construction of the final portion of the concrete river wall, and the erection of the necessary lock buildings. In addition to these contract operations, hired-labor work was continued during the year, the expenditures therefor having been applied to the paving of four waste weirs, the placing of the remaining portion of the toe wall for an embankment 1,650 feet long on the river side of the canal, the completion of the additional masonry required to bring the lock walls to the requisite height under the modified project, the construction of a road from Riverton to the lock and along the south bank of the canal, sodding portions of the canal slopes, and other minor operations. A contract was entered into for furnishing and erecting the upper and lower lock gates.

The district officer recommends in his report an additional allotment of $150,000 for completing the Colbert Shoals Canal. His recommendation is concurred in.

The sum given as a profitable expenditure in the fiscal year 1911 at Hales bar will be applied to the procurement by contract of the electrical machinery and equipment for operating the gates and valves, to providing lock houses, office, roads, walks, etc., to grading grounds, etc., and to the expenses of supervision and inspection.

It is proposed to apply the amount recommended for open-channel work, $360,000, to dredging and dike construction at shoal places

between Chattanooga and Riverton, to providing a suitable working plant for this section of the river, and to maintenance of the existing channel, the object of the proposed work being to extend the benefits already secured from open-river improvement, and in addition to render available the important advantages to be derived from the opening of Colbert Shoals Canal to navigation.

The sum estimated as a profitable expenditure for the fiscal year 1911 at Colbert and Bee Tree shoals, $150,000, is to be applied to riprapping the banks of the canal where necessary, to purchasing and installing under contract the guard gates, filling valves, and operating mechanism of the lock, and to contingent expenses.

The commerce carried on the river between Chattanooga and Florence in the calendar year 1908 amounted to about 202,450 tons, the estimated value of which is given as $8,115,735. The most important items were general merchandise, cotton, and timber products.

For references to details of the river from Chattanooga to Riverton, see Annual Report of the Chief of Engineers for 1905, page 456.

HALES BAR LOCK AND DAM.

July 1, 1908, balance unexpended	$85,539.75
Amount allotted from appropriation by river and harbor act approved March 3, 1909	15,000.00
	100,539.75
June 30, 1909, amount expended during fiscal year, for works of improvement	19,835.26
July 1, 1909, balance unexpended	80,704.49
July 1, 1909, outstanding liabilities	186.38
July 1, 1909, balance available	80,518.11
July 1, 1909, amount covered by uncompleted contracts	51,828.00
Amount (estimated) required for completion of existing project	101,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	[a] 101,750.00

OPEN-CHANNEL WORK.

July 1, 1908, balance unexpended	$176,270.78
Received from sales	18.78
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	181,289.56
June 30, 1909, amount expended during fiscal year, for works of improvement	77,977.10
July 1, 1909, balance unexpended	103,312.46
July 1, 1909, outstanding liabilities	13,992.75
July 1, 1909, balance available	89,319.71
Amount (estimated) required for completion of existing project	1,031,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	360,000.00

[a] Of this amount $50,875 is for continuing contract work authorized by the river and harbor act of March 3, 1909.

COLBERT AND BEE TREE SHOALS.

July 1, 1908, balance unexpended	$376,160.74
Received from sales	472.80
Amount appropriated by sundry civil act approved March 4, 1909	120,000.00
	496,633.54
June 30, 1909, amount expended during fiscal year, for works of improvement	346,214.64
July 1, 1909, balance unexpended	150,418.90
July 1, 1909, outstanding liabilities	38,161.65
July 1, 1909, balance available	112,257.25
July 1, 1909, amount covered by uncompleted contracts	88,385.08
Amount (estimated) required for completion of existing project	639,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	150,000.00

(*c*) *Below Riverton, Ala. (226 miles).*—This section of the river lies below most of the large tributaries; and the slope being uniform and moderate and the width nowhere excessive, it affords unusual facilities for navigation. The ruling low-water depths were originally about 3.5 feet over the lower 196 miles and 2 feet in the remaining portion. The average slope is 0.34 foot per mile, and the low-water discharge is about 10,000 cubic feet per second. In 1896 there were 49 localities having less than 5 feet depth at low water, and several other shoals have since developed.

The existing project, originally adopted September 19, 1890, and subsequently extended in its scope by the acts of August 18, 1894, and March 3, 1899, is to obtain, by dredging, a channel not less than 5 feet deep and 150 feet wide, and to protect Livingston Point and Tennessee Island from erosion with a view to preserving the port of Paducah, Ky.

The appropriations and allotments for this section amount to $397,197.74, and sums aggregating $838.49 have been received from other sources, making a total of $398,036.23.

The total amount expended to June 30, 1909, was $376,325.93, including about $57,197.05 for maintenance.

This expenditure has resulted in the completion of the work at Livingston Point and Tennessee Island at a cost of $77,367.65; in the removal of snags and the dredging of about 1,127,660 cubic yards of gravel at about 31 localities, thus removing the worst obstructions below Hamburg; and in the maintenance of the working plant employed in this section. The results of the dredging operations appear to be fairly permanent at about two-thirds of the places improved. The work done in the season of 1907 has been of unusual value.

The smallness of the balance available during the working season of 1908 and the high stages of the river that prevailed after funds became available from the enactment of March 3, 1909, rendered it impracticable to carry on any field operations during the fiscal year. The expenditures for the year (including the amount applied to maintenance) were incident to the construction and repair of floating plant and the purchase of supplies, preparatory to commencing the season's work.

The maximum draft that can be carried over the shoalest place in this section at mean low water is about 3 feet. The extreme flood oscillations range from about 48 feet at Johnsonville to about 55 feet at Paducah.

The commerce carried on the river between Florence and Paducah during the calendar year 1908 amounted to about 552,560 tons, the estimated value of which is given as $10,636,445; the principal items in order of value being general merchandise, railroad ties, peanuts, and cotton. Railroad ties formed the most considerable item in point of tonnage.

In the appendix to this report the district officer gives his reasons for recommending an increased appropriation for this section, and his recommendation is concurred in. It is proposed to apply the amount estimated as a profitable expenditure in the fiscal year 1911 to maintenance of the existing waterway and to channel improvement at the shoal places offering the greatest obstruction to navigation. The work proposed will result in an extension of the benefits already secured, and will, moreover, serve an important purpose in rendering more fully available the improvement to be effected by the canal at Colbert and Bee Tree shoals, now nearing completion.

July 1, 1908, balance unexpended		$4,373.53
Received from sales		512.70
Amount allotted from appropriation by river and harbor act approved March 3, 1909		25,000.00
		29,886.23
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$4,873.53	
For maintenance of improvement	3,302.40	
		8,175.93
July, 1909, balance unexpended		21,710.30
July 1, 1909, outstanding liabilities		3,432.76
July 1, 1909, balance available		18,277.54
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		150,000.00

BIG SANDY RIVER AND LEVISA AND TUG FORKS, WEST VIRGINIA AND KENTUCKY.

For more extended information concerning the early history of this improvement, reference is made to the following Annual Reports of the Chief of Engineers: For the year 1875, pages 756–769; for the year 1904, Part 1, page 479, and for the year 1905, Part 1, pages 488–489.

In their original condition this river and its forks were much obstructed by rocks, bars, snags, and leaning trees. During the low-water period of each year navigation was practically suspended.

The original project was adopted July 18, 1878, and provided for the removal of rocks, snags, and overhanging trees from the Big Sandy River and its forks. The construction of a lock and fixed dam below the junction of the two forks and near Louisa, Ky., was added by the act of June 14, 1880, and in 1891 was modified to admit of the construction of a movable instead of a fixed dam.

The work of clearing the forks of obstructions is carried on from year to year as funds are made available.

The amount expended on original and modified projects prior to operations under existing project, exclusive of maintenance on Levisa and Tug Forks, was $380,590.66.

The existing project, adopted March 3, 1899, contemplates carrying slack water from the Ohio River to Pikeville, on Levisa Fork, and to the mouth of Pond Creek, on Tug Fork, by the construction of 21 locks and dams, at an estimated cost of $4,725,000. Of these locks and dams 10 are proposed for the Levisa Fork, 8 for Tug Fork, and 3 for the main river. The survey made for this improvement developed the fact that only 2 locks and dams would be required for the main river.

The raising of the crest of Dam No. 3, at Louisa, Ky., was added by the act of June 13, 1902, at an estimated cost of $35,000.

The improvement at the mouth of the Big Sandy River by the construction of regulating works was added by the act of March 3, 1905, at a cost of $40,000.

The construction of a steel service bridge at Lock No. 1, Big Sandy River, was added by the act of March 2, 1907, at a cost of $7,000.

The amount expended on the work of the existing project up to the close of the fiscal year ending June 30, 1909, was as follows:

Big Sandy River, general improvement, including maintenance	$955,502.44
Levisa Fork, maintenance	32,192.41
Tug Fork, maintenance	31,284.06

And at that date all work of this project applicable to the main river, Catlettsburg to Louisa, was completed, with the exception of the steel service bridge at Lock No. 1, which has been deferred for reasons set forth on page 606 of the Annual Report of the Chief of Engineers for 1908.

Lock No. 1, Tug Fork, and Lock No. 1, Levisa Fork, have been completed, and Dam No. 1, Tug Fork, under contract dated July 22, 1908, and Dam No. 1, Levisa Fork, dated July 29, 1908, were partially completed.

With the exception of the service bridge at Lock No. 1, which is provided for by a specific appropriation, the work is being carried on under the continuing-contract system, and the balance of the authorization remaining to be appropriated is $25,000. This amount, in addition to the unexpended balance on June 30, 1909, can be profitably expended in the fiscal year ending June 30, 1911, in the extension of benefits by the construction, and partial completion of the accessories, of Dam No. 1, Tug Fork, and Dam No. 1, Levisa Fork.

In connection with the work under contract for constructing Dam No. 1, Tug Fork, and that covered by contract for constructing Dam No. 1, Levisa Fork, unforeseen conditions have presented themselves which will materially increase the cost of completing these works. Quicksand has been encountered, which will greatly increase the amount of excavation and deposit and, in addition to the authorization of $25,000 contained in the river and harbor act of March 3, 1909, an additional appropriation of $25,000 is recommended, that amount being considered necessary to complete the work as originally contemplated and to provide a maneuvering boat at each lock, estimated to cost $5,000 each.

An additional appropriation of $3,000 is recommended for the construction of a steel service bridge at Lock No. 1, Big Sandy River, the appropriation of $7,000 contained in river and harbor act of March 2, 1907, being deemed insufficient for reasons explained on page 606, Annual Report of the Chief of Engineers for 1908.

For reasons stated in the appendix to this report, the district officer considers a small dredging plant necessary for the operation and maintenance of this improvement, and estimates the cost of same at $20,000. It is recommended that funds be appropriated for the construction of this plant.

Three locks and dams on the Big Sandy River have been completed and opened to navigation. They provide a minimum depth of 6 feet on their lower miter sills, except at Lock No. 1, Catlettsburg, Ky., where the depth on the lower miter sill depends upon the stage in the Ohio River, and is uncertain and will remain so until a dam is placed in the Ohio River immediately below Catlettsburg.

The minimum draft that can be carried over the shoalest portions of the forks at mean low water is uncertain and changeable, and can not be definitely stated owing to the constant movement of the bottom and the fact that the obstructions naturally renew themselves.

It is deemed advisable that provision should be made for the necessary surveys to locate sites and for acquisition of land required for additional locks and dams, to be constructed under the adopted project, in order to avoid delays incident to such work after appropriations for actual construction have been made.

Commercial statistics are reported under the head of operating and care of locks and dams on Big Sandy River, West Virginia and Kentucky (see below).

The Big Sandy River is navigable by steamer from Catlettsburg, the mouth of the river, up to Louisa, Ky., a distance of 27 miles, and from there to Chapman, Ky., on Levisa Fork, a distance of 9 miles, and to Saltpetre, W. Va., on Tug Fork, a distance of 4 miles. For pole boats, rafts, etc., the head of present navigation is taken at Pond Creek on Tug Fork and at Pikeville on Levisa Fork.

It is believed that the work thus far accomplished on this improvement has had no material effect on freight rates.

Reference to report on examination made in compliance with act of March 2, 1907, will be found on page 612, Annual Report of the Chief of Engineers for 1908.

July 1, 1908, balance unexpended		$271,583.26
Received from sales		25.50
Amount allotted from appropriation by river and harbor act approved March 3, 1909		50,000.00
		321,608.76
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$172,096.64	
For maintenance of improvement	245.27	
		172,341.91
July 1, 1909, balance unexpended		149,266.85
July 1, 1909, outstanding liabilities		1,427.75

July 1, 1909, balance available	$147,839.10
July 1, 1909, amount covered by uncompleted contracts	119,473.66
Amount (estimated) required for completion of existing project	3,705,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	[a] 28,000.00

KENTUCKY RIVER, KENTUCKY.

For more extended information, reference is made to the Annual Report of the Chief of Engineers for the year 1906, Part 1, pages 541 and 542. At the time the United States assumed control of the Kentucky River the improvement that had been made by the State of Kentucky, which included five locks and fixed dams, was found to be in a dilapidated and almost worthless condition. Portions of Dams Nos. 1 and 2 on the lower part of the stream were gone entirely, so that navigation was suspended.

The original and existing project was adopted in 1879 (Annual Report of the Chief of Engineers for 1879, pp. 1398–1422) and provides for repairing and rebuilding the five old locks and dams, removing snags, logs, and other obstructions, and extending 6-foot slackwater navigation from the mouth of the river to the Three Forks, a distance of about 261 miles.

The amount expended to June 30, 1909, was $3,094,100.81.

The result of this expenditure was the repair and the rebuilding of five old locks and dams constructed by the State; the construction of Locks and Dams Nos. 6, 7, 8, 9, 10, and 11; the purchase of sites for these and for Locks and Dams Nos. 12, 13, and 14, and the partial construction of Locks and Dams Nos. 12 and 13; construction of dam at Beattyville, Ky., and survey to determine the amount of damage by flowage to private property by reason of the construction of these works.

This work is being carried on under the continuing-contract system and the total amount authorized for this improvement has been appropriated.

The present unexpended balance will become exhausted with the completion of Lock No. 13, with the exception of a possible balance of $50,000; in addition thereto an appropriation of $165,000 will be necessary for the construction of the dam and abutment.

The estimated cost of Lock and Dam No. 14 is $415,650, not provided for in any existing legislation.

The construction of Locks and Dams Nos. 9 and 10 has caused damages to the highways of Madison County by backwater in Tates Creek and Otter Creek. Tates Creek enters the Kentucky River about one-half mile above Lock 9. There is a county road crossing this creek a few hundred feet above the mouth, which is the principal outlet for a large number of residents dwelling on the left-hand side going up this creek. Since the construction of Dam No. 9 this crossing has been rendered useless. In order to restore the crossing a bridge will have to be constructed. From estimates already obtained it is thought that a suitable bridge can be built for approxi-

[a] Of this amount, $25,000 is for continuing contract work authorized by the river and harbor act of March 3, 1909, and $3,000 for completing steel service bridge at Lock No. 1, Big Sandy River.

mately $3,500, and an appropriation of this amount is therefore recommended. Otter Creek is situated one-half mile below Ford, Ky., and one-half mile above Dam No. 10. Since the construction of this dam the county road running along this creek has been rendered impassable. This road meets the Richmond and Boonesboro (Ky.) turnpike and is the principal outlet for a large number of families scattered along this creek. For the purpose of restoring this road to public traffic an appropriation of $2,500 is recommended. This work constitutes an item of contingent expense that was not foreseen when the estimate of cost of constructing these locks and dams was prepared, and an appropriation of $6,000 to cover the cost of the additional work indicated is a proper charge to this improvement and should be provided in addition to sums heretofore authorized.

The greatest draft which can be carried at mean low water from Lock No. 1 to a point 2 miles above Irvine, Ky. (a distance of 220 miles), which is at present the head of slack-water navigation, is 5.5 feet. Above this point no boats can run at a low stage.

Ordinary low-water depth through Lock No. 1 and to the Ohio River, 4 miles below, is 6 feet or more, but at extreme low water only about 2½ feet can be carried over the lower sill of Lock No. 1. The usual variations of level of water surface are from 23 to 40 feet and occasionally much more.

Approximate amount of commerce, 1908	tons..	318,565
Approximate value of commerce		$5,001,470.50
Approximate number of passengers		11,546

The principal commerce of the river is timber, much of it loose logs, and the improvement is rather detrimental to this than otherwise. The logs are damaged in passing the dams, and in their turn cause much damage to the works—are a prolific source of snags and of discouragement to any steamboat traffic that might develop.

Commercial statistics in detail are given in the report for operating and care of locks and dams on Kentucky River (see Report Chief of Engineers, vol. 2, p. 1836).

The unexpended balance and appropriation recommended will be applied to construction of Locks and Dams Nos. 12 and 13 for extension of benefits.

There are not likely to be any decided changes in the volume or character of the commerce benefited until the improvement is carried to the head of the river, where it is hoped that coal lands may be developed and the product shipped by river. The development of coal lands, with the resulting traffic, is the specific purpose to which the expenditure will be applied. It is believed that the project has so far had no material effect on freight rates.

July 1, 1908, balance unexpended	$544,881.44
Received from sales	168.00
Amount appropriated by sundry civil act approved March 4, 1909	210,000.00
	755,049.44
June 30, 1909, amount expended during fiscal year, for works of improvement	166,660.97
July 1, 1909, balance unexpended	588,388.47
July 1, 1909, outstanding liabilities	910.00
July 1, 1909, balance available	587,478.47

July 1, 1909, amount covered by uncompleted contracts	$496,152.33
Amount (estimated) required for completion of existing project	655,650.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	165,000.00

GUYANDOT RIVER, WEST VIRGINIA.

The following is the report of the Board of Engineers on a recent survey of this river, printed in House Document No. 558, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS.
Washington, D. C., July 8, 1907.

Respectfully returned to the Chief of Engineers, U. S. Army.

In the within report the district officer gives a brief account of preliminary examinations heretofore made of Guyandot River, to which he refers for information as to the physical characteristics of the stream and the territory through which it flows.

The improvement of this river was first undertaken by a company acting under a charter from the State of Virginia, by the construction of 6 timber locks and dams, carrying slack water from the Ohio River to above the "falls," the upper lock being 30 miles from the Ohio. These structures, however, had about disappeared when the United States commenced work in 1878, in accordance with a project providing for the removal of snags and other obstructions. Under this project, $22,689.90 was expended to June 30, 1904, resulting in fairly good navigation over a distance of 119 miles.

In 1894 Maj. D. W. Lockwood, Corps of Engineers, made an examination of Guyandot River with a view of improvement by locks and dams; and in his report thereon careful consideration was given to the physical adaptability of the stream to improvement for slack-water navigation and the commercial necessity for such improvement. The report on this examination was unfavorable to the improvement specified in the law, as was also a report rendered by Capt. H. F. Hodges, Corps of Engineers, in 1899, on an examination of the river from its mouth to a point 50 miles above, ordered by act of March 3, 1899.

The country tributary to the river contains a large amount of timber and some partially developed coal fields, but it is not particularly well adapted to agriculture, nor has it any large industrial establishments requiring water transportation, and there are no large towns upon its banks. Statistics of commerce contained in the Annual Reports of the Chief of Engineers indicate that the stream carried between 1897 and 1903 an average of 151,000 tons per annum. Nearly all of this commerce was timber and cross-ties, the amount of miscellaneous merchandise varying between 5,000 and 10,000 tons annually.

Owing to the considerable fall of this stream, amounting to about 147.76 feet between the mouth and Logan, 81½ miles above, a radical improvement could only be secured by means of locks and dams, but conditions are not favorable for such an improvement. As this river is paralleled by two streams, its watershed is limited and its low-water discharge, which is reported to be about 20 cubic feet per second, does not vary greatly throughout the dry season. The denudation of the timber lands may be expected in the future to result in slightly increased run-off during flood stages, with a consequently diminished low-water discharge. Slack-water improvement does not appear to be warranted by the insignificant steamboat commerce on the river, and it would be an obstacle rather than an advantage to the floating of timber, which is now the only commerce of importance on the stream. The transportation of coal has recently been provided for by the construction of a railroad from which spurs can be constructed directly to the mines if warranted by the output.

In the opinion of the Board, no commercial necessity exists for a radical improvement of the river. It concurs with the district officer and the division engineer that the benefits to be derived from such an improvement would not be commensurate with the large expenditure required, and that it is inadvisable to undertake any work other than the maintenance of the natural channel by the removal of obstructions interfering with the floating of timber, substantially as carried on heretofore under the original project for the improvement of the stream.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

KANAWHA RIVER, WEST VIRGINIA.

A description of the condition of the river, the projects, and the general work accomplished (the locks and dams being in operation) are contained in the Annual Report of the Chief of Engineers for 1900, page 490.

The amount expended under the original project is $50,000; that expended under the present project to June 30, 1909, is $4,181,501.89 ($2,949.15 was received from sales, etc.).

Plans are nearly completed for guide walls for upper approaches to Locks Nos. 4 to 11, and considerable progress made on plans for snag boat and quarter boat for use on this river. Work under this appropriation was suspended, however, due to the provisions contained in section 10 of the sundry civil act approved March 4, 1909, and no other work was undertaken during the year, although under authority of joint resolution approved June 25, 1909, the balance of this appropriation was again made available.

For reasons stated in the appendix the district officer recommends the reconstruction of the ice pier at the mouth of the river at an estimated cost of $24,000.

The maximum draft that can be carried at the shoalest part of the slack-water system at mean low water is 6 feet. The highest stage reached during the year was 16 feet at Charleston; the lowest 0.3 foot at the falls. Loup Creek shoal, about 90 miles from the mouth of the river, is the head of navigation for steamboats and other craft.

The commerce for the calendar year 1908 amounted to 1,035,401 tons, with a valuation of $4,243,619. Of the foregoing there were 965,000 tons of coal and 38,274 tons of timber products, valued at $820,250 and $165,260, respectively.

The improvement of this river having been gradual, it is difficult to give the exact effect the improvement has had upon freight rates. There is no doubt, however, that freight rates, where transportation by water is available, are regulated thereby. A reduction in the passenger rate by railroads has materially decreased the number of passengers traveling on the Kanawha River packets.

A report of the examination of the unimproved section of the river, about 4½ miles between Lock No. 2 and Kanawha Falls, is contained in the Annual Report of the Chief of Engineers for 1904, page 2587.

July 1, 1908, balance unexpended	$46,583.98	
Amount received from sale	58.40	
		46,642.38
June 30, 1909, amount expended during fiscal year, for works of improvement		3,331.98
July 1, 1909, balance unexpended		43,310.40

The following is from the report of the district officer:

As the mouth of the Kanawha is particularly well adapted for an ice harbor, the piers which were built at Point Pleasant to form an ice harbor, and which have become so dilapidated as to make them practically worthless for the purpose, should be rebuilt. It is believed that the most economical construction for these piers would be concrete, the estimated cost of which is $24,000.

Request has been received from those interested in the improvement of this river for the addition of guide walls to the locks for the lower entrances. Such walls would prove a benefit to the general navigation of the river.

LITTLE KANAWHA RIVER, WEST VIRGINIA.

A description of the original condition of the river and its availability for purposes of commerce are given in the Annual Report of the Chief of Engineers for 1875, page 740.

The original project provided for removing rocks, snags, and overhanging and fallen trees above Burning Springs, W. Va., at a cost of $7,300, as adopted by Congress on August 14, 1876. The act of Congress of June 14, 1880, made provision for the construction of a lock and dam about 2 miles above Burning Springs. This lock was opened to navigation on December 2, 1891, and has since been maintained under the indefinite appropriation for operating and care of canals and other works of navigation. Funds are appropriated from time to time for maintaining the present channel by the removal of obstructions which have re-formed.

Congress, in the act of March 3, 1905, provided $75,000 for the purchase and $88,000 for the repair of Locks and Dams Nos. 1–4, owned by the Little Kanawha Navigation Company, the project for which is contained in House Document No. 309, Fifty-eighth Congress, second session, as given in the Annual Report of the Chief of Engineers for 1904, page 2607.

Of the $81,000 made available by act of March 2, 1907, $79,500 is for the improvement of the structures purchased from the Little Kanawha Navigation Company, as set forth in detail on page 534 of the Annual Report of the Chief of Engineers for 1906; $1,000 for maintenance of improvement above Burning Springs; and $500 for making a preliminary survey for a lock and dam above Lock No. 5. The survey has been completed.

An allotment of $30,000 for completing the repairs to Locks Nos. 1 and 3 was made from the amount appropriated by the river and harbor act of March 3, 1909.

The amount expended to June 30, 1909, is $405,665.70, of which $2,554.23 was applied to maintenance, $75,000 to acquisition, $114,129.13 to repair of Locks and Dams Nos. 1–4, and $500 to survey above Lock No. 5 ($186.10 was received from sale of unserviceable property).

A small force was employed during October, 1908, in removing obstructions from the channel between Creston and Grantsville, a distance of 76 miles. Work done under War Department permits was inspected.

Repairs to Lock and Dam No. 2 were completed, and the lock at No. 3 repaired. New guide cribs were built at Locks Nos. 3 and 4, and a spur dike built at Lock No. 1. Obstructions were removed from the pools. The land required at Locks Nos. 1 and 4 was purchased, and steps taken to procure that required at Locks Nos. 2 and 3.

The maximum draft which can be carried at mean low water over the shoalest place in that section of the river under maintenance of improvement is 6 inches. During high water steamboats run to Glenville, 102 miles from the mouth. The head of gasoline-boat and push-boat navigation is Burnsville, 120 miles from the mouth; rafting, however, extends some miles above.

Slack-water navigation extends from the mouth of the river to Creston, W. Va., a distance of 48 miles, and provides a depth of 4 feet. Owing to the poor condition of the structures purchased from

the Little Kanawha Navigation Company, this depth has not been maintained during the low-water season, as the repairs provided for have not been completed.

Between Creston and Burnsville the high-water mark ranges from 28 feet at Creston to 24 feet at Burnsville. During very dry seasons there are only a few inches of water on the shoals. The highest stage reached during the year was 25.45 feet at Lock No. 5.

A statement of the commerce is contained in the report for operating and care of locks and dams on Little Kanawha River, West Virginia. (See p. 634 of this report.)

Gasoline boats which formerly plied above Lock No. 5 are now running to Parkersburg. Some new gasoline boats have been built.

Until the extensive repairs contemplated at Locks and Dams Nos. 1 and 3 are completed, river navigation will not have a decided effect on freight rates by rail. The rates by river were reduced in an amount equal to the tolls charged by the navigation company since the Government assumed control of Locks Nos. 1–4.

It is estimated that $500 can be profitably expended during the fiscal year ending June 30, 1911, for maintaining the channel above Burning Springs, W. Va., by removing obstructions which re-form from time to time.

Reports on an examination of the river between Lock No. 5 and Burnsville and on the locks and dams "not owned by the Government" are contained in the Annual Report of the Chief of Engineers for 1904, pages 2597 to 2617.

Report on survey for a lock and dam above the location of existing Lock No. 5, required by the river and harbor act of March 2, 1907, is printed in House Document No. 917, Sixtieth Congress, first session.

The river and harbor act of March 3, 1909, provides for an examination of the "Little Kanawha River with a view to the modification of the existing system of locks and dams and its further improvement," and report thereon will be submitted to Congress at its next session.

ABOVE LOCK NO. 5.

July 1, 1908, balance unexpended	$1,208.66
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	641.13
July 1, 1909, balance unexpended	567.53
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	500.00

PURCHASE AND REPAIR OF LOCKS NOS. 1–4.

July 1, 1908, balance unexpended	$7,951.10
Amount allotted from appropriation by river and harbor act approved March 3, 1909	30,000.00
	37,951.10
June 30, 1909, amount expended during fiscal year, for works of improvement	7,878.87
July 1, 1909, balance unexpended	30,072.23
July 1, 1909, outstanding liabilities	727.43
July 1, 1909, balance available	29,344.80
July 1, 1909, amount covered by uncompleted contracts	4,643.02

BETTERMENTS, LOCKS NOS. 1–4.

July 1, 1908, balance unexpended		$65,738.28
June 30, 1909, amount expended during fiscal year, for works of improvement		12,439.64
July 1, 1909, balance unexpended		53,298.64
July 1, 1909, outstanding liabilities		160.00
July 1, 1909, balance available		53,138.64

CONSOLIDATED.

July 1, 1908, balance unexpended		$74,898.04
Amount allotted from appropriation by river and harbor act approved March 3, 1909		30,000.00
		104,898.04
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$20,318.51	
For maintenance of improvement	641.13	
		20,959.64
July 1, 1909, balance unexpended		83,938.40
July 1, 1909, outstanding liabilities		887.43
July 1, 1909, balance available		83,050.97
July 1, 1909, amount covered by uncompleted contracts		4,643.02
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		500.00

CLEVELAND HARBOR, OHIO.

Originally Cleveland Harbor was simply the mouth of Cuyahoga River, in which the water was shoal and sometimes the entrance was entirely closed to boats by the sand. The first improvement was undertaken in 1825, and the plan contemplated straightening the channel and making it permanent by side jetties. The channel was dredged when necessary. The total expenditure under this plan was $346,244.84.

In 1875 a project was adopted for a breakwater of timber cribs in 5 fathoms of water. The west breakwater was commenced in 1876 and completed in 1883, a total length of 7,130 feet. The east breakwater was commenced in 1888 and continued at intervals until 1893, when its length was 2,494.5 feet. In 1895 an opening of 200 feet was made in the shore arm of the west breakwater as a sanitary measure.

In 1896 Congress authorized the completion of the improvement at a total estimated cost not to exceed $1,354,000, in accordance with a project published in Annual Report of the Chief of Engineers for 1896, pages 2949 to 2953, inclusive. This project involved the completion of the east breakwater, covering an extension of about 3,000 feet; removing superstructure of the old west breakwater to a depth of 2 to 3 feet below water level and replacing it with a superstructure of concrete masonry; reenforcing the cribs below the masonry; sheathing the face of the east breakwater; removing and rebuilding the east and west piers and widening the mouth of the river. A continuous contract for the work was authorized.

In 1899 a project was prepared, and was authorized by the river and harbor act of that year, for deepening the channel and sheltered

area by dredging to a depth of 21 feet. This project was enlarged by the act of June 13, 1902, to permit the dredging to be carried to a depth of 25 feet. The estimated cost of the work was $478,400. (See Annual Report of the Chief of Engineers for 1899, pp. 3076 to 3078, inclusive, for project, and p. 3061 for estimate as revised.)

The river and harbor act of June 13, 1902, authorized a further modification of the project by providing for improving and enlarging the entrance to the harbor and for extending the breakwater eastward to Gordon Park, in the city of Cleveland, a distance of about 16,000 feet, at a total estimated cost of $4,481,456. This project is described in the Annual Report of the Chief of Engineers for 1901, pages 3277 to 3299, inclusive. The act authorized an expenditure of $2,800,000, of which $100,000 is yet to be appropriated, but this authorization was increased by $900,000 in the river and harbor act of March 2, 1907, of which $600,000 is yet to be appropriated. This act also appropriated $98,000 for the construction of a government dock at the foot of Erie street, in the city of Cleveland, in accordance with plan printed in House Document No. 270, Fifty-ninth Congress, second session, contingent upon the consent of the Cleveland Yacht Club, which holds a lease of this frontage.

The existing project for improving Cleveland Harbor, Ohio, is therefore a combination of those authorized by the acts of 1875, 1896, 1899, 1902, and 1907.

There has been expended on this project to June 30, 1909, $5,523,-698.53, of which amount $508,259.72 was for maintenance during the past six years. Prior to that time the amounts expended for works of improvement and for maintenance were so involved that it would be impracticable to separate them.

With this expenditure the mouth of the river has been widened, the east and west piers rebuilt and capped with concrete, with the exception of a small amount of jetty extension and dredging near the mouth of the Cuyahoga River and south of the Lake Shore Railway bridge, which has not been carried out because the United States has been unable to obtain title to the land which would have to be dredged away. The superstructure of the west breakwater has been removed and replaced by concrete masonry, and the lake face of the cribs protected with riprap. The old east breakwater has been repaired and extended as provided for in the project of 1896, with the exception of about 270 feet, which, being a portion of the shore arm, was not built on account of the modifications in the river and harbor act of June 13, 1902, which rendered its construction unnecessary.

The work at the new entrance was completed October 6. This consists of two pierheads, two projecting breakwaters, and rubble-mound protection for the old structure. The western division of the east breakwater extension was completed October 27, 1908, the eastern division is 85 per cent complete, and work under a contract dated January 14, 1909, for the new extension eastward is 18 per cent complete.

Construction of the wharf at the foot of East Ninth street was commenced June 1, 1909.

From 1899 to 1904, 766,928 cubic yards of material was excavated in the harbor, at a cost of $115,000; but, as shown by the annual report of the district engineer for 1904, the deposit which took place over this area during this period has equaled or exceeded the amount

of material removed, and the work done therefore must be regarded simply as maintenance work and not in advancement of the project.

A contract for dredging in the basin was completed November 24. Under this contract 801,628 cubic yards of material was removed.

As a result of these expenditures a navigable channel 25 feet in depth has been provided at the mouth of the river and a large outer harbor constructed which is available for docks and anchorage. The project as a whole is regarded as 80 per cent completed.

The amount recommended to be appropriated will be applied to building pierheads, east entrance, and shore arm of the east breakwater.

Cuyahoga River has a navigable depth of 20 feet to Jefferson street, 4 miles above its mouth, and 16 feet for 1½ miles farther, and is maintained by local authorities.

There has been a marked reduction in freight rates since the project was inaugurated, but it is impracticable to determine how much of this reduction is due to this particular improvement.

The commerce for Cleveland Harbor for the calendar year 1908 amounted to 10,159,170 tons, a decrease of 2,713,278 tons from that reported for the calendar year 1907.

The usual variation in the level of the water surface during the season of navigation is from 1 foot above to 2 feet below mean lake level. Fluctuations due to wind are about 2 feet.

UNDER CONTRACTS, ETC., AUTHORIZED BY ACT OF JUNE 3, 1896.

July 1, 1908, balance unexpended	$45,484.84
July 1, 1909, balance unexpended	45,484.84

MAINTENANCE (DREDGING) AND CONTINUING IMPROVEMENT.

July 1, 1908, balance unexpended	$104,791.17
June 30, 1909, amount expended during fiscal year, for works of improvement	47,007.48
July 1, 1909, balance unexpended	57,783.69
July 1, 1909, outstanding liabilities	23.96
July 1, 1909, balance available	57,759.73
Amount (estimated) required for completion of existing project	203,000.00

WHARF ROOM.

July 1, 1908, balance unexpended	$98,000.00
June 30, 1909, amount expended during fiscal year, for works of improvement	57.08
July 1, 1909, balance unexpended	97,942.92
July 1, 1909, outstanding liabilities	171.20
July 1, 1909, balance available	97,771.72
July 1, 1909, amount covered by uncompleted contracts	83,735.00

NEW ENTRANCE, BREAKWATER EXTENSION, ETC., ACTS OF JUNE 13, 1902, AND MARCH 2, 1907.

July 1, 1908, balance unexpended	$672,040.99
Amount appropriated by sundry civil act approved March 4, 1909	337,500.00
	1,009,540.99
June 30, 1909, amount expended during fiscal year, for works of improvement	472,029.04
July 1, 1909, balance unexpended	537,511.95
July 1, 1909, outstanding liabilities	55,194.15
July 1, 1909, balance available	482,317.80
July 1, 1909, amount covered by uncompleted contracts	1,010,433.09
Amount (estimated) required for completion of existing project	1,481,456.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	[a] 194,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

CONSOLIDATED.

July 1, 1908, balance unexpended	$920,317.00
Amount appropriated by sundry civil act approved March 4, 1909	337,500.00
	1,257,817.00
June 30, 1909, amount expended during fiscal year, for works of improvement	519,093.60
July 1, 1909, balance unexpended	738,723.40
July 1, 1909, outstanding liabilities	55,389.31
July 1, 1909, balance available	683,334.09
July 1, 1909, amount covered by uncompleted contracts	1,094,168.09
Amount (estimated) required for completion of existing project	1,684,456.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	[a] 194,000.00

CONNEAUT HARBOR, OHIO.

Report on a recent survey is printed in House Document No. 653, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, February 4, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated April 10, 1909, and January 20, 1910, with map, by Lieut. Col. John Millis, Corps of Engineers, on preliminary examination and survey, respectively, called for by the river and harbor act approved March 3, 1909, of Conneaut Harbor, Ohio, with a view to enlarging and improving the outer harbor area.

Conneaut Harbor is being improved by the United States under a project adopted by the river and harbor act of June 3, 1896, which provides for completing the jetties to a depth of 17 feet in Lake Erie; the construction of two detached breakwaters converging toward the lake and designed to shelter the entrance to the jettied channel and for securing a navigable depth of 20 feet in the channel and sheltered area.

[a] Of this amount, $100,000 is under the continuing-contract authorization made in the river and harbor act approved June 13, 1902, and $94,000 under act of March 2, 1907.

It appears that the anchorage area in the outer harbor is anadequate for the large and growing commerce of the harbor, and the district officer presents a plan, as shown on the map, for enlarging this area by reenforcing the present east breakwater with concrete top and extending it toward the shore about 800 feet (A), also extending it into the lake on its present line about 900 feet (B), terminating in a pierhead; the main harbor entrance to be 600 feet wide; a new outer breakwater with pierhead to be built on the west side of the harbor area, extending west 1,000 feet (C), thence 3,700 feet toward shore (D); removing about 600 feet of the outer end of the present inner breakwater on the west side (E); removing about 500 feet of the outer end of the inner east government pier (F); and dredging to 21 feet depth the outer harbor areas (G–H); all at an estimated cost of $1,338,681, with not to exceed $10,000 annually for maintenance. It is proposed to utilize as much of the old work as is practicable.

I concur in the opinion of the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors that the locality is worthy of further improvement as proposed, but I consider that the details of the work should be subject to such minor modifications as may appear necessary or desirable during the execution of the project.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

In the report of the Board is the following statement in regard to the commerce of the harbor:

The commerce of the harbor is extensive and has been rapidly increasing, as indicated by the following:

	Tons.
1895	405,518
1900	3,332,607
1905	6,556,282
1909	9,776,469

FAIRPORT HARBOR, OHIO.

This harbor is situated at the mouth of Grand River, 30 miles east of Cleveland. Before the improvement was undertaken the depth across the bar at the mouth of the river was variable.

The first improvement was undertaken in 1825, and the original project provided for the construction of parallel jetties of cribwork filled with stone, placed about 200 feet apart and extending outward across the bar and into the lake. The jetties were extended from time to time until the west jetty attained a length of 2,370 feet and the east jetty 1,765 feet from the original shore line. These jetties have been repeatedly repaired and rebuilt as necessities required, and the channel has been deepened and dredged many times.

By the river and harbor act of June 3, 1896, the existing project for this improvement was adopted. This project is described in the Report of the Chief of Engineers for 1896, pages 2956 to 2958, inclusive, and provides for the construction of two breakwaters converging toward the lake, the outer ends being in deep water, and sufficient space being left between them to afford an easy entrance to the jettied channel. The breakwaters were to terminate in pierheads 50 feet square, the west breakwater to have a length of 2,050 feet and the east breakwater 1,350 feet. The estimated cost of the work, including dredging between the breakwaters to a depth of 20 feet, was $510,000, which was revised to $585,000 in 1900. (See Annual Report of the Chief of Engineers for 1900, pp. 4071–4072.)

A further modification of the project occurs in the river and harbor act of March 3, 1905, which provides that the westerly arm of the breakwater may be extended to a point at or near the shore, the expense thereof to be paid from the appropriations therein and heretofore made. The estimated cost of this extension was $120,000.

The total expenditures to June 30, 1899, on the original project, were $368,940.09.

The river and harbor acts of June 13, 1902, and March 3, 1905, provided not only for continuing existing project, but for maintenance of the old work. From the various appropriations since 1899 there have been expended $196,167.25 in repairs to old piers and dredging. With these funds 580 linear feet of the shoreward end of the east jetty was completely rebuilt of timber cribs with a concrete top, and 570 linear feet of the west jetty was extensively repaired with tongued and grooved piling below the water and with concrete and stone above, and the outer portion of both jetties was protected below water by a sheathing of hard-wood plank, and the wooden superstructure was completely repaired.

With funds available for continuing the improvement, 828 linear feet of the shoreward end of the west breakwater, as provided for in the report of 1896, has been built, extending to the shore. The work of extending the west breakwater 1,000 feet lakeward and for the construction of a pierhead at its outer end is in progress under contract. This work is about 65 per cent complete.

There has been expended on the existing project to June 30, 1909, $504,540.89, of which amount $125,358.32 was for maintenance during the past six years. Prior to that time the amounts expended for works of improvement and for maintenance were so involved that it would be impracticable to separate them.

The water surface variations are similar to those of Cleveland.

The amount recommended to be appropriated will be applied to building the east arm outer breakwater.

The result of these expenditures has been to obtain a channel 20 feet deep at mean lake level across the bar at the mouth of the river and to protect the entrance from westerly storms. The project is regarded as about 55 per cent completed.

There has been a marked reduction in freight rates since the project was inaugurated, but it is impracticable to determine how much of this reduction is due to this particular improvement.

The commerce of Fairport Harbor for the calendar year 1908 amounted to 2,302,275 tons, a decrease of 1,021,220 tons from that reported for the calendar year 1907.

July 1, 1908, balance unexpended		$155,614.63
Amount allotted from appropriation by river and harbor act approved March 3, 1909		5,000.00
		160,614.63
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$74,929.20	
For maintenance of improvement	2,850.26	
		77,779.46
July 1, 1909, balance unexpended		82,835.17
July 1, 1909, outstanding liabilities		13,190.09
July 1, 1909, balance available		69,645.08
July 1, 1909, amount covered by uncompleted contracts		61,636.82
Amount (estimated) required for completion of existing project		245,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909		245,000.00

HURON HARBOR, OHIO.

This harbor is situated at the mouth of Huron River. In its natural condition the entrance was practically closed by a sand bar.

The first project for its improvement was adopted in 1826 and provided for the construction of two parallel jetties 140 feet apart, extending outward from the river banks. These jetties were lengthened from time to time and repaired as required, and the channel was finally deepened by dredging.

The total amount expended upon these projects for all purposes of construction and maintenance to June 30, 1905, was $269,789.07.

The present project for the improvement of this harbor was authorized by the river and harbor act of March 3, 1905. It is based upon a survey plan and estimate called for by the river and harbor act of June 13, 1902, and is published in full in the Report of the Chief of Engineers for 1904, pages 3209 to 3218, inclusive.

It provides for rebuilding 580 feet of the west jetty, extending it 240 feet and constructing a pierhead 50 feet square at its outer end; for a second pierhead of the same dimensions and 300 feet easterly from it; for a jetty or breakwater extending from this east pierhead to a point on shore 1,200 feet easterly from the channel; for the removal of the old east jetty; and for the dredging of the channel and a part of the sheltered area to a depth of 21 feet below mean lake level.

In the spring of 1904 it was necessary to make an allotment of $40,000 from the river and harbor act of April 28, 1904, for the maintenance of this harbor. This money has been expended in rebuilding about 490 linear feet of the shoreward end of the west jetty, which was in such ruinous condition that it threatened to give way and to involve the destruction of the channel. This extension directly advanced the project and diminished proportionally the amount required for its completion.

The river and harbor act of March 3, 1905, appropriated $68,500 and authorized contracts to be entered into for $200,000 more for the completion of the new projects. Of this latter sum all but $3,000 has now been appropriated.

The work contemplated in the latest project has been completed, with the exception of a small amount of dredging in the sheltered area.

The excavation necessary in connection with the execution of the project and for maintenance of channel has been done during the past year by the U. S. dredge *Maumee;* 65,986 cubic yards of material was removed from the sheltered area, at a cost of $10,632.95.

The amount expended under the existing project to June 30, 1909, was $248,461.68, of which amount $10,471.31 was for maintenance.

The result of these expenditures has been to obtain a channel 200 feet wide and 21 feet deep at mean lake level through the outer bar and jettied channel for a distance of three-fourths of a mile. The project is regarded as 99 per cent completed.

A channel 8 feet deep extends to Milan, 8 miles above the mouth, but there is practically no navigation on this part of the river.

The appropriation recommended will be applied to maintenance to keep the improvement available.

There has been a marked reduction in freight rates since the project was inaugurated, but it is impracticable to determine how much of this reduction is due to this particular improvement.

The commerce for Huron Harbor for the calendar year 1908 amounted to 1,167,574 tons, a decrease of 1,153,881 tons from that reported for the calendar year 1907.

July 1, 1908, balance unexpended		$57,315.09
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$9,599.66	
For maintenance of improvement	7,165.80	
		16,765.46
July 1, 1909, balance unexpended		40,549.63
July 1, 1909, outstanding liabilities		442.70
July 1, 1909, balance available		40,106.93
Amount that can be profitably expended in the fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		3,000.00

LORAIN HARBOR, OHIO.

The following is from House Document No. 644, Sixty-first Congress, second session, submitting a report on a recent survey:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, February 3, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated April 14, 1909, and January 20, 1910, with map, by Lieut. Col. John Millis, Corps of Engineers, on preliminary examination and survey, respectively, called for by the river and harbor act of March 3, 1909, of Lorain Harbor (Ohio), with a view to enlarging and improving the outer harbor area; also the dock wall on the east side of the river extending east of the government pier shoreward to connect with completed work.

This harbor is being improved by the United States under a project adopted by the river and harbor act of March 3, 1899, which provides for the construction of two rubble mound breakwaters converging toward the lake, having an opening between them at their outer extremities 500 feet in width, in prolongation of the axial line of the jettied channel; also for repairing the jetties and for dredging the protected areas to a depth of 20 feet, the project being about 95 per cent completed. The district officer presents, with recommendation for adoption, a plan for further improvement by extending the west breakwater about 1,500 feet toward shore, A; extending east breakwater about 800 feet toward shore, B; dredging outer harbor area, C; dredging outer harbor area, D; all as shown on the map, at an estimated cost of $248,129. He estimates that the probable cost of maintenance will not exceed $5,000 per year.

These reports have been considered by the Board of Engineers for Rivers and Harbors, pursuant to law, and the Board agrees with the district officer and the division engineer in the opinion that the commercial importance of this harbor is sufficient to justify the further improvements proposed.

I concur in this view.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

THE SECRETARY OF WAR.

The commerce of the harbor is quite large and has been increasing substantially, as will be seen from the following:

Year.	Tons.
1895	564,055
1900	1,546,709
1905	3,265,486
1909	4,895,090

The following report on a recent survey of Black River, Lorain Harbor, in which the Chief of Engineers concurs, is printed in House Document No. 560, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., September 16, 1907.

Respectfully returned to the Chief of Engineers, U. S. Army.

In the within report the district officer submits an estimate of cost, in the sum of $23,000, for enlarging that portion of Black River from the inner end of the government piers to East Erie Avenue Bridge, in Lorian Harbor, by widening the channel to the dock lines which have been established by local authorities, and providing a depth of 20 feet below mean lake level. He believes this work is worthy of being undertaken by the United States, provided the local authorities suitably revet the channel when constructed and thereafter maintain the improvement. The division engineer concurs in the opinion of the district officer as to the advisability of the improvement.

The Board concurs with the district officer and the division engineer in recommending that the project for the improvement of Lorain Harbor be modified to include the enlargement of Black River between the inner ends of the government piers and the East Erie Avenue Bridge, at an estimated cost of $23,000, provided suitable revetments are constructed by local authorities and the channel maintained by them after completion, and the Board further recommends that no expenditure be made from any future appropriations for this work unless and until satisfactory assurances be given to the Secretary of War, by bond or otherwise, that suitable revetments will be constructed by local authorities and the improvement maintained by them after completion.

The act of March 2, 1907, ordering the above preliminary examination, also authorized the expenditure of $15,000 from the appropriation for improving harbor at Lorain, for "dredging on the easterly side of Black River from the inner end of the easterly government pier to East Erie Avenue Bridge." This work being included in the project herein submitted by the district officer, at an estimated cost of $23,000, an appropriation of $8,000 will cover the cost of completing the improvement.

For the Board.

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

PORT CLINTON HARBOR, OHIO.

The harbor of Port Clinton is within the mouth of the Portage River. This river flows into Lake Erie at a point about 13 miles by land and 22 miles by water west of the city of Sandusky. In its natural condition the depth of water on the bar at the mouth of the river rarely exceeded 5 feet at ordinary lake level.

The original project for its improvement was adopted in 1871 and was slightly modified in 1872 and 1873. It provided for the construction of two parallel jetties extending outward from the mouth of the river to a depth of 10 feet in the lake, at an estimated cost of $90,000. These were built of timber and stone.

The jetties were extended to a depth of 10 feet in the lake in 1883, at which time the east jetty had been extended 2,180 linear feet and the west jetty 1,948 linear feet. These lengths were thought sufficient for the requirements of this harbor, and in 1894, at which time a total expenditure of $71,949.86 had been made, it was recommended that the remainder of the estimated cost of executing the project ($21,000) be expended for necessary repairs.

The project since 1894 has been one for maintenance, under which $30,104.82 has been expended.

The result of these expenditures has been to produce a channel about 10 feet in depth, extending for one-half mile above the mouth

of the Portage River, which was the maximum draft that could be carried June 30, 1909. A channel of 6 feet depth extends to Oak Harbor, 12 miles above the mouth of the river.

The appropriation recommended will be applied to maintenance to keep the improvement available.

The project has had little effect on freight rates, as the commerce of the port is small.

No work under contract has been done at Port Clinton during the year.

The commerce of Port Clinton for the calendar year 1908 amounted to 13,068 tons, an increase of 2,217 tons over that reported for the calendar year 1907.

July 1, 1908, balance unexpended	$0.71
Amount allotted from appropriation by river and harbor act approved March 3, 1909	2,500.00
	2,500.71
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	55.39
July 1, 1909, balance unexpended	2,445.32
July 1, 1909, outstanding liabilities	45.00
July 1, 1909, balance available	2,400.32
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	1,000.00

SANDUSKY HARBOR, OHIO.

The harbor of Sandusky is in the lower part of Sandusky Bay, along the city front, the part nearest to the lake being about 2 miles from the bar which divides the waters of the bay from those of the lake. In its natural condition the depth was only such as the bay afforded, which was about 10 feet along the city front and from 9 to 12 feet thence to the lake, at ordinary lake level.

A long, flat sand bar divided the bay from the lake, this bar being cut through by a channel from 1,000 to 2,000 feet in width near its central portion. The southern part of the bar is called "Cedar Point" and the northern "Sand Point." Between these two points the currents between the bay and the lake had scoured out the channel to a depth of not less than 18 feet for a distance of a mile or more.

The first appropriation was made for a survey in 1826, and the first improvement was made in 1844, consisting in the construction of a dam to close a breach across Sand Point. With this exception, all the improvements made previous to 1896 consisted in deepening natural channels and in making a new straight channel from the city front to Cedar Point and in removing sand and bowlders from the dock channel along the city front. Natural causes since 1826 have washed away a greater part of Sand Point.

In 1896 and subsequently the project was added to so as to provide for the construction of parallel jetties of stone upon mattress foundations extending from Cedar Point and Sand Point outward, with a view to confining and directing the flow of water to and from the bay. Provision was also made for the construction of certain spurs and

mattresses for the protection of the channel near Cedar Point and at the point of the bar near the light-house.

Under the original project thus modified there was expended $477,149.09.

The present project, authorized by the river and harbor act of March 3, 1899, is described in the Annual Report of the Chief of Engineers for 1898, pages 2708 to 2716, inclusive. It provides for an east jetty of stone upon brush mattresses extending from Cedar Point about 5,000 feet into the lake; for a west jetty 5,500 feet long on the opposite side of the channel, about 750 feet distant; for the protection of the crest of the bar and shore of Sand Point with a low dam of brush and stone, and for a deflecting dike for inner bar 1,500 feet long and dredging to 17 feet. The estimated cost was $425,796, of which $317,796 was for permanent works. By the river and harbor act of June 13, 1902, the project was modified so as to provide for dredging a channel 21 feet deep at mean lake level with a width of 400 feet in the approaches to the harbor front and 300 feet in the harbor channel, at an estimated cost of $781,000, as described in the Report of Chief of Engineers, 1901, pages 3270 to 3277, inclusive. The estimated cost of the entire project as revised in 1903 was $1,135,000.

The act of March 3, 1905, modified the project by omitting therefrom the excavation of rock other than that already provided for by contract in the dock channel and fixed the limit of expenditures at $815,000. Continuing contracts in excess of cash appropriations were authorized by the same act to the amount of $480,000, of which $130,000 remains to be appropriated. The act of March 2, 1907, restored this work of rock removal to the project and appropriated $125,000 for maintenance and continuing the improvement. In the interim the city of Sandusky had removed considerable rock from the channel.

The total expenditures under the present project for improving Sandusky Harbor to June 30, 1909, is $602,004.90, of which amount $27,403.48 was for maintenance during the past six years. Prior to that time the amounts expended for works of improvement and for maintenance were so involved that it would be impracticable to separate them.

Under the appropriation of $125,000 in the river and harbor act of March 2, 1907, a contract is in force for the removal of rock in the dock channels. During the past year under this contract there has been removed 93,387 cubic yards of material. A portion of the rock removed was deposited in the extension of the east jetty, where it can be used for the building up of this protection. The U. S. dredge *Burton* worked in the outer channel from November 25 to December 4, removing 16,907 cubic yards of material at a cost of $1,055.92.

The result of these expenditures has been to create a channel 300 feet wide and 21½ feet deep through the outer bar, 400 feet wide and 20½ feet deep to the city front, and 160 to 300 feet wide and 20 feet deep along the city front to the Short Line docks, completing 99 per cent of the work now under contract. The project as a whole is regarded as about 70 per cent completed.

There is at present, however, some shoaling, which reduces the available width to a minimum of 200 feet through the outer bar and

to a minimum of 250 feet in the channel between the outer bar and the city front.

The appropriation recommended will be applied to maintenance to keep the improvement available.

There has been a marked reduction in freight rates since the project was inaugurated, but it is impracticable to determine how much of this reduction is due to this particular improvement.

There is a general depth of 10 feet in Sandusky Bay to the mouth of the Sandusky River, 14 miles above the city, and of 8 feet in the river to Fremont, Ohio, 18 miles above its mouth, but there is practically no navigation above Sandusky. The usual variation in the level of the water surface is the same as at Toledo, with extreme fluctuations of 5 feet above and below mean lake level.

The receipts and shipments at the harbor of Sandusky for the calendar year 1908 amounted to 1,295,474 tons, a decrease of 944,387 tons from that reported for the calendar year 1907.

July 1, 1908, balance unexpended		$281,416.83
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$65,650.80	
For maintenance of improvement	2,728.02	
		68,378.82
July 1, 1909, balance unexpended		213,038.01
July 1, 1909, outstanding liabilities		8,341.22
July 1, 1909, balance available		204,696.79
July 1, 1909, amount covered by uncompleted contracts		11,167.65
Amount (estimated) required for completion of existing project		135,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		10,000.00

TOLEDO HARBOR, OHIO.

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 865, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., March 9, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

In reviewing the report of the district officer on the preliminary examination of "Maumee River, from deep water in Lake Erie to the Fassett Street Bridge," the Board explained the peculiar physical conditions which at times operate to reduce the depth in Toledo Harbor to such an extent as to seriously interfere with navigation. These considerations appeared to justify the making of a survey to fully determine the advisability of the United States undertaking the additional improvement desired, and the Board therefore recommended that the district officer be authorized to make a survey and prepare an estimate of cost for a channel 23 feet deep at mean lake level from deep water in Lake Erie to the Fassett Street Bridge, the width to remain 400 feet, this being deemed sufficient for the needs of navigation except at the range lights where an easing of the bends appears desirable.

In the within report on the survey the district officer submits an estimate of cost amounting to $400,000 for constructing within the limits mentioned above a channel 21 feet deep "below the low water of 1895," which is the plane of reference adopted for the channels connecting the waters of the Great Lakes, having an elevation of 570.8 feet above mean tide at New York, while the plane of "mean lake level" has an elevation of 572.8 feet above mean tide at New York. The project of the district officer is therefore the work recommended by the Board—that is, 23 feet below mean lake level;

but the Board does not believe that it is desirable to adopt for Toledo Harbor a plane of reference not in accord with that which is the basis of all existing harbor improvements on Lake Erie. The adoption of dissimilar planes of reference for the harbors of the same lake is apt to lead to confusion among those not familiar with the hydrographic conditions. For these reasons the Board believes that the plane of "mean lake level" which has been adopted for Lake Erie harbors should be adhered to until it be found advisable to adopt a new reference plane for all Lake Erie harbors.

It is the opinion of the Board that the commercial interests involved amply justify the expenditure required to accomplish the improvement now proposed, and it therefore recommends that the project for this locality be modified to provide for a channel 23 feet deep at mean lake level and 400 feet wide from deep water in Maumee Bay to the Fassett Street Bridge, Toledo, with suitable easement of bends at the range lights, at a total cost of $400,000, and a yearly outlay of $25,000 for maintenance after completion of the improvement.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

Toledo is a city having a population of 131,822, according to the census of 1900. There was received and shipped from this harbor during the calendar year 1906, 4,522,280 tons of freight. Its commerce has doubled in the past ten years and increased 900,000 tons in the past year. It is the fourth of the Ohio ports on Lake Erie in receipts and shipments, and fifth in the tonnage of vessels entering and clearing, being exceeded by Cleveland, Ashtabula, and Conneaut in receipts and shipments, and by Lorain in addition to the cities above mentioned in clearances. It contains numerous factories and is a large railroad center. Its commerce is of sufficient magnitude to justify a considerable expenditure in the improvement of its harbor, and the city is entitled to navigable facilities equal to those at other localities on the Great Lakes.

VERMILION HARBOR, OHIO.

Vermilion Harbor is at the mouth of Vermilion River, which empties into Lake Erie about 20 miles eastward from Sandusky.

The improvement of this harbor was first undertaken in 1836, when an appropriation of $10,000 was made for the purpose. The original project provided for parallel jetties extending outward to 12 feet of water in the lake. The jetties were built, but the current only sufficed to maintain a channel of about 7 feet depth across the bar at ordinary lake level.

In the natural condition of the harbor there was only about 2 feet of water at this place. Dredging was accordingly resorted to and the project enlarged to provide for a depth of 14 feet of water. This involved the removal of rock, and the project was never fully executed.

The total amount of money expended on the original project is $133,277.55.

No work has been done under contract at Vermilion during the past year.

The amount expended on the existing project for maintenance to June 30, 1909, was $29,964.13.

The result of these expenditures has been to provide a channel 12 feet deep to the inner end of the piers. A channel of 8 feet extends to the Lake Shore Railway bridge, one-half mile above. The water-surface fluctuations are similar to those at Huron or Lorain.

The appropriation recommended will be applied to maintenance to keep the improvement available.

The improvement has had little effect on freight rates, as the tonnage of the port is small.

The receipts and shipments for the calendar year 1908 amounted to 1,355 tons, a decrease of 254 tons from that reported for the calendar year 1907.

July 1, 1908, balance unexpended	$155.82
Amount allotted from appropriation by river and harbor act approved March 3, 1909	2,000.00
	2,155.82
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	119.95
July 1, 1909, balance unexpended	2,035.87
July 1, 1909, outstanding liabilities	.40
July 1, 1909, balance available	2,035.47
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	1,000.00

OHIO RIVER, PROJECT FOR NINE FEET DEPTH.

Following are extracted from House Document No. 492, Sixtieth Congress, first session:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, January 10, 1908.

SIR: The river and harbor act approved March 3, 1905, in the item making appropriation for the further improvement of the Ohio River, contains the following:

"The Secretary of War is hereby authorized and directed to appoint a board of engineers to examine the Ohio River, and report, at the earliest date by which a thorough examination can be made, the necessary data with reference to the canalization of the river, and the approximate location and number of locks and dams in such river, with a view both to a depth of six feet and nine feet; and in said report shall include the probable cost of such improvement with each of the depths named, the probable cost of maintenance, and the present and prospective commerce of said river, upstream as well as downstream, having regard to both local and through traffic. They shall also report whether, in their opinion, such improvement should be made, and whether other plans of improvement could be devised under which the probable demands of traffic, present and prospective, could be provided for without additional locks and dams, or with a less number than is described in surveys heretofore made, giving general details relating to all of said plans and the approximate cost of completion thereof. They shall also examine the said river from the mouth of the Green River to Cairo, with a view to determining whether an increased depth can be maintained by use of dredges."

On May 12, 1905, by authority of the Secretary of War, and in accordance with the provisions of the act just quoted, a Board of officers of the Corps of Engineers, consisting of Lieut. Col. D. W. Lockwood, Lieut. Col. Ernest H. Ruffner, Lieut. Col. Clinton B. Sears, Maj. George A. Zinn, and Maj. Wm. L. Sibert, was constituted by the Chief of Engineers and directed to assemble at Cincinnati, Ohio, at the call of the senior member to carry out the purposes of the act. Capt. Harry Burgess, Corps of Engineers, was assigned to duty as recorder of the board.

The Board made an inspection of the river, organized and conducted a hydrographic survey, and collected data and statistics from all available sources bearing upon the several features required by law to be reported upon. The report of the Board, dated December 15, 1906, is presented herewith for transmission to Congress. Its perusal will show how careful and thorough has been the work of the Board and to what degree of confidence the report is entitled.

Taking up in order the objects of inquiry specified in the law, the Board finds that a 6-foot navigation at low water can be established in the Ohio River from Pittsburg to

Cairo by the construction of 45 locks with movable dams, at an estimated cost of $50,962,266 in addition to funds heretofore appropriated and authorized; that a 9-foot navigation over the same length of river can be established by the construction of 54 locks and dams, at an estimated cost of $63,731,488. The Board estimates the annual cost of maintenance at $15,000 for each lock and dam, making a total of $675,000 for the 6-foot project and $810,000 per annum for the 9-foot project. It should be noted, however, that these maintenance estimates do not take into consideration any dredging which may be found necessary in the pools. This subject will be considered later.

The Board gives exhaustive consideration to the question of present and probable commerce, both downstream and up, and it appears that the present commerce of the river is approximately 9,000,000 tons per annum, of which a large proportion is downstream. Having in view the fact that a canalized river offers an upstream navigation lower in cost and quicker in transit than an open-river project, the Board, arguing from the known natural resources of this section and its population, concludes that a river improved by this method will afford facilities for the cheap exchange of mineral, agricultural, and manufactured commodities, which from their low value and bulk can not be exchanged unless such cheap facilities are offered, and that there is every probability that the improvement of the Ohio River by canalization, as proposed, would induce a very large future commerce which does not now exist in addition to retaining and greatly facilitating and cheapening the commerce which the river now bears. The Board adverts to the probable opening of the ship canal, for which Congress has recently given a national charter, from the lakes to the Ohio Valley and notes that an improved Ohio River will form a natural link in extension of this canal to all parts of the Ohio and Mississippi valleys.

The Board finds that the probable demands of traffic, present and prospective, can not be provided for by any other plan of improvement not having locks and dams, or having a less number of locks and dams than those proposed in the report.

The Board further finds that a 6-foot depth can be maintained by dredging below Green River, but that a 9-foot depth can not be maintained economically.

After careful discussion of the factors entering into the cost of transportation by water the Board finds that the probable cost per ton-mile for a 6-foot project will be 0.0653 cent, or 63.14 cents for a ton of coal delivered at Cairo from Pittsburg. For a 9-foot project the corresponding figures are 0.0447 cent and 43.25 cents, showing an economical advantage in the ratio of 3 to 2 in favor of the deeper project as compared with an increased cost ratio of 5 to 6 only. The estimated cost in both cases is materially increased by the necessity of making provision for the present unique method of coal transportation on the Ohio River, a method which has been developed by long experience, which has cut down the cost of transportation to a figure unprecedented in the history of commerce and which is apparently so well grounded on sound economical considerations that it can not and should not be disturbed. A project ignoring this method of transportation of coal and adapted to all other forms of traffic now found on the Ohio River or likely to be developed as a result of the improvement, could be devised on an estimated cost materially less than that herein presented, but such a project at a lesser cost does not appear to be admissible and is not considered.

The Board therefore finally recommends that the 9-foot project, involving 54 locks and dams at an estimated cost of $63,731,488, should be adopted.

As provided by law this report was referred to the Board of Engineers for Rivers and Harbors for review. This Board made a personal inspection of the river and held a public hearing at Pittsburg on August 12, 1907, at which hearing the representatives of the various localities interested in the proposed improvement furnished written statements in advocacy thereof. In its report on this subject, dated October 18, 1907, the Board of Engineers for Rivers and Harbors, reviewing the former report in detail and submitting views differing somewhat on minor points from those expressed by the special Board, nevertheless coincides in the conclusions of that Board and recommends, without qualification, the improvement as proposed by that Board.

The Board of Engineers for Rivers and Harbors calls attention to the necessity for dredging in the pools as an item of maintenance and expresses the opinion that the maintenance cost of the special Board for the 9-foot project of about $800,000 per annum should be increased on this account to $1,000,000 per annum.

In transmitting this report of the special Board organized under the explicit mandate of Congress I think it important to emphasize certain unusual features of it and to comment upon the same.

It will be noted in the first place that, by a plain inference, the conclusions of the report depend upon a conjectural future commerce rather than upon the commerce now existing or plainly in sight. It is, in fact, an assumption of the restoration of the field of commercial usefulness which the river enjoyed before the advent of any rival

method of transportation. It is assumed that commerce will always seek the route which it finds cheapest, cost and convenience considered, that by the method of improvement proposed the cost and convenience in both directions on the Ohio River can be made less than by any other method of transportation, and that under such conditions the traffic will surely seek the river. Attention is called by the Board of review to the fact that Congress has not up to this time sanctioned a project of such extent as this upon considerations of this character. Whether it ought to sanction either of these projects would appear to be a matter purely for legislative determination, based upon such data as are supplied by this report or as may be obtained by further inquiry. The original Board and the Board of review are both convinced that the probability of increased traffic is sufficiently strong to justify the proposed expenditure—this from the standpoint of ordinary business considerations—and from this standpoint I concur in this view. The question as to whether a step in advance shall be taken and whether this apparently good business proposition shall be made the basis of legislation for entering upon the improvement I prefer to leave to the wisdom of Congress.

On one point, however, my convictions are most strong and emphatic, and that is that there is no hope for success in the development of such a commerce as is predicated for the Ohio River by any other method of improvement than the one proposed. It is possible that a further study of the situation and a thorough revision of the project might reveal the possibility of reducing the number of locks and dams slightly and giving higher lifts to the latter, thus accomplishing better results at slightly decreased cost, but I entertain no doubt whatever that the development of a large future commerce, seeking the river in preference to other methods on account of the increased convenience and diminished cost of freight movement, depends absolutely upon a method of improvement which will have a tendency to remove or minimize the present vastly different conditions between upstream and downstream traffic. The unprofitableness of the upstream movement has always been a drag upon the downstream movement, whereas every increment of the upstream traffic on a profitable basis will have a tendency to decrease the cost and increase the amount of downstream traffic. The greatest disparity of conditions between the downstream and upstream freight movement resides in the current which hampers both, though not equally.

The pronounced advantage of lake over river transportation is very largely the result of the absence of current in the former. It follows that a scheme of improvement of the Ohio River promising success must present as one of its features a diminution of current, which can not be attained in any appreciable degree by any open-channel method.

Very respectfully,

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS.

WASHINGTON, D. C., *October 18, 1907.*

GENERAL: The Board of Engineers for Rivers and Harbors has had under consideration the report of a Board of Engineers convened by Special Orders, No. 17, War Department, Office of the Chief of Engineers, Washington, May 12, 1905, for the purpose of examining the Ohio River and reporting with reference to its canalization.

The Board held a public hearing at Pittsburg August 12, 1907, at which representatives of the various localities interested in the proposed improvement presented statements, which are appended, and from August 13 to 18, inclusive, made a personal inspection of the river from Pittsburg to Cairo.

The existing project for the improvement of the Ohio River provides for the regulation of the river channel by the closure of chutes, the contraction of the channel by wing dams and training walls, and excavation of shoals by dredging. Navigation around the falls at Louisville during low stages of the river is through a canal. At stages above 12.7 feet on the gauge vessels pass over the falls through Indiana chute, which has been improved for the purpose, at a 12.7-foot stage the falls being sufficiently drowned out to admit of up-river navigation. There has been expended on the general improvement of the river to June 30, 1906, $6,696,333.76, and on improving and maintaining the Louisville and Portland Canal and Falls of the Ohio $3,906,258.90.

While it has been considered that the regulation of the river by wing dams and training walls can successfully secure a minimum navigable depth of 3 feet, this result has not yet been accomplished with the funds expended, and no estimate of the cost of completing the work has been submitted.

It was recognized at an early date that the movement of coal, which has heretofore been the principal item of commerce on the river, required a channel of a depth of at least 6 feet, a channel which it was considered impracticable to obtain by regulation,

especially in the upper river where the slopes are steep and the minimum river discharge small (about 1,600 cubic feet per second). Congress has authorized the construction of 6 locks and movable dams immediately below Pittsburg which were originally designed to secure a low-water channel of 6 feet for a distance of 28.8 miles and it has recently authorized their enlargement so as to obtain a channel of 9 feet. It has also authorized the construction of locks and dams designed for 9 feet navigation so as to create pools in front of East Liverpool, Steubenville, Marietta (the mouth of the Muskingum River), Point Pleasant (mouth of the Great Kanawha River), Cincinnati, and above the falls at Louisville.

There was appropriated for these various works prior to the river and harbor act of March 2, 1907, $9,281,376.

In the report under consideration it is recommended that a series of locks and movable dams, 54 in number, be constructed between Pittsburg and Cairo of such height as to insure a depth of channel of 9 feet at all stages of the river, the locks to have a length of 600 feet and width of 110 feet. The Louisville and Portland Canal is also to be enlarged and an additional lock constructed 85 feet in width and 600 feet in length. The estimated cost of the work in addition to funds appropriated and authorized for lock and dam construction on the Ohio River prior to the act of March 2, 1907, is $63,731,488. The estimated annual cost of maintenance is $15,000 per lock and dam.

There is discussed a project for obtaining a navigable channel of 6 feet depth with similar locks and dams. The locks would be 45 in number, 5 less than heretofore proposed, and the estimated cost $50,962,266 in addition to funds heretofore appropriated and authorized. There is also discussed the practicability of obtaining and maintaining by dredging navigable channels of 6 and 9 feet depth from the mouth of the Green River to Cairo, and the opinion is expressed that an increased depth up to 6 feet can be maintained by dredges from the mouth of the Green River to Cairo, but that it is not economically practicable by dredges to maintain a 9-foot depth over this stretch of river.

There is presented in the report a statement of the commerce of the river (Table 1, page 40), prepared by the Ohio Valley Improvement Association, which gives receipts and shipments of the various towns along the river in 1905, amounting to 13,955,918 tons. A table (No. 3, page 48) is also submitted of the movement of freight at the mouths of the various tributaries of the river, amounting to 7,474,615 tons. The sum of these figures does not, however, represent the freight movement as these tables contain numerous duplications, an article shipped at one locality being reported as received at another, and Table 1 apparently giving as shipments and receipts at Pittsburg and vicinity the same items which appear in Table 3 as passing the Davis Island dam, and at Paducah in Table 1 the movement in the Tennessee River given in Table 3.

The sum of the receipts in Table 1 amounts to 7,069,362 tons and of shipments to 6,645,056 tons, the tonnage of Wheeling amounting to 241,500 tons not being classified. Deducting the tonnage passing Davis Island dam and moving at the mouth of the Tennessee River from the amount of tonnage reported in Table 3 there remains a tonnage of 2,532,627 entering and departing from the tributaries which has not been included in Table 1.

It appears from the reports of the Chief of Engineers that of this amount about 2,300,000 tons is coal, logs, and other timber products. There also moves on the Mississippi between Cairo and Memphis about 2,057,051 tons of coal, logs, and timber products and 161,312 tons of other articles, some of which come from the Upper Mississippi. The reports do not state whether the movement of these products is into or out of the rivers. Coal, logs, and timber products, however, generally move downstream, and if the relatively small amount of freight composing other products be assumed as moving upstream the resultant error in computing the freight traffic on the Ohio will be slight. Under these assumptions there were received at the various towns on the river and moved out of the various tributaries and down the Mississippi about 9,359,040 tons of freight, and sent from the various towns and moved into the river from the Mississippi and the various tributaries 9,347,868 tons, indicating a freight movement on the Ohio of about 9,350,000 tons.

A large proportion of this commerce is coal. Of the freight reported as passing through the Davis Island Dam, 91 per cent consists of this product; through the Louisville and Portland Canal and over the Falls of the Ohio at Louisville, 92 per cent. This coal is loaded in barges drawing from 5½ to 8½ feet, and low water is stored in certain pools until a rise of the river affords sufficient depth to enable the barges to float over the river shoals when they are guided down the river in large fleets by a single steamboat.

This method of transportation affords a very cheap means of handling freight, much cheaper than usually obtains on improved rivers and canals. It has been re-

ported to the Board that coal has been shipped from Pittsburg to New Orleans at a rate less than 0.4 of a mill per ton-mile, a rate the same as that charged at present on coal shipped on the 20-foot waterway between Buffalo and Duluth, where it is taken as a return cargo, the charge on iron ore from Duluth to Buffalo being at about twice that rate. The only instances known to the Board of cheaper rates are on ocean vessels of deep draft moving over long distances.

The project submitted in the report is designed so as to interfere with this method of transportation as little as practicable. A wide navigation pass is constructed in the dams which can be lowered whenever a rise occurs and leave an unobstructed river through which coal fleets can be moved as at present, and the locks have been given such dimensions that when the dams are raised the smaller coal fleets which now navigate the river can pass through them without breaking tow. It makes provision for an enormous commerce, as it is estimated that 20,000 tons can be locked from one pool to another in one and a half hours, or at the rate of about 100,000,000 tons in one direction per annum even if the dams are not lowered.

The practicability of the proposed system of locks and dams has been thoroughly tested at Davis Island, 4.7 miles below Pittsburg, where a lock and dam of a similar character have been in operation since 1885, and the estimates of the cost of the work submitted are based upon experience acquired in the construction of that work and the other locks and dams which have been authorized by Congress.

As to the estimate submitted for annual maintenance, $15,000 per lock and dam, the Board notes that the average annual expenditure for maintenance both at the Davis Island Dam and at the Louisville and Portland Canal has largely exceeded these figures. The estimate, moreover, only includes the salaries of the lock force and the cost of repairs and renewals, and no allowance is made for dredging in the pools.

The regimen of the Ohio River, especially as regards the character of the banks and the nature of the bottom, changes at or near the mouth of the Green River, and below this point the Ohio River approaches in its general characteristics much more closely to that of the lower Mississippi.

The amount of material brought into the river by caving banks and of sediment pushed along the bottom is for this stretch of the Ohio River considerable, and numerous sand bars are found. These sand bars build up during high water and are cut down during subsequent low water. If the river be improved by locks and movable dams the bar building will proceed during high water in practically the same manner as in the unimproved river, but the bar-cutting action of low water will be interfered with by the raising of the movable dams at the very time when this bar cutting is most active. It is probable, therefore, that the building of the bars during the high water and the cessation of the cutting during low water will have a tendency to gradually increase the size of the sand bars and the height of their crests, and that in consequence the amount of the annual dredging necessary to maintain a navigable channel, even with a system of lock and movable dams, will in a few years be quite large. The Board is of the opinion that a liberal estimate for dredging should be made, and places the cost of maintenance of the system at not less than $1,000,000 per year.

While a more economic system of improvement of the river could be devised than that submitted in the report by means of fixed dams and locks of dimensions more in accord with those usually adopted on rivers and canals, the Board is of the opinion that such a system would be such a hindrance to the existing coal trade as to preclude its use. The economy which results in handling coal in large fleets of barges will tend to preserve the existing method of transportation, and even if the river were canalized, as proposed, it is believed that much of the coal transported would be moved as at present on rises and when the movable dams are down. Nor does the Board consider that the saving which would accrue to existing commerce by the proposed improvement would be sufficient to justify its cost. In fact, the losses claimed to be sustained by the coal interests due to delays in shipment under existing conditions are less than one-half the cost of maintaining the proposed waterway, and it is believed that as much coal is now shipped by water as there is a demand for on the lower rivers. A material increase in the commerce of the river must therefore be created by the improvement and a change in the character of the freight carried to warrant such an expenditure. Nor is the Board prepared to indorse fully the views expressed as to the benefits to be derived from river transportation over that by rail. Railroads possess certain inherent advantages which compensate in great measure for the cheapness with which freight can be moved by water. The railroad companies have become the great agencies for transportation in this country. They have connected the principal towns with cheap lines of communication penetrating the field, the mine, the factory, and the warehouse. They have expended large sums in developing their terminal facilities in the various cities through which they pass and have erected elevators and other auxiliaries to reduce terminal charges. By consolidating into

vast trunk lines, the cars collected by the branches are moved long distances in train-load lots with great economy.

Lines of river transportation are restricted in location. They must follow the thalwegs of the larger valleys and can only penetrate a small part of the country. Except in the case of the comparatively few mines and factories which are situated on their banks it is necessary to transport by car or wagon from the shipping point to the waterways and then transship and reverse these operations to reach the terminal, while the railroad can ship from the mine to the factory or warehouse without breaking bulk.

Branch lines by rail or wagon are a necessity to an efficient water route. But in determining the cost of transportation by water the cost of these lateral feeders is not usually considered, while it forms a large percentage of the cost of rail transportation.

On the main lines of the various railway systems freight is being transported in train lots at a rate of less than 2 mills per ton-mile and it is natural for the railroads to endeavor to reap the benefits of a long haul and not surrender the most profitable portion of their trade to a rival water route. It would be unreasonable to expect them to act as feeders to a water route at a rate per ton-mile the same as they now charge for carrying freight from New Orleans to Pittsburg in competition with it, nor can they be compelled to turn over to rival carriers their warehouses, elevators, and other terminal facilities which they have erected at great expense.

Distances by rail are considerably shorter than by river, which compensates to a certain extent for their greater rate per ton-mile. A short water route can not successfully compete with a great railway system for through commerce. To be a success it must be of such a length that the great transportation companies will themselves find it advantageous to ship over it.

The waterways connecting the Great Lakes have enormously developed in the past ten years, but the railways have reaped the benefits. Neither the Canadian canals down the St. Lawrence River nor the Erie Canal across New York State have responded to the growth of the lake commerce. The success of the Great Lakes as a means of transportation has not resulted from competition between the great systems of transportation and outside parties, but from the utilization of the waterway by the railroads themselves, which have expended millions of dollars to improve their terminal facilities and have established the large fleets which navigate the lakes.

But the great cause of the failure of waterways as a means of transportation in the United States is that they heretofore have not generally followed a commercial route, but have led from nowhere to no place. The river systems of the country flow generally in a southerly direction, while the trend of commerce has been east and west. Until within the last ten years a railroad running north and south was generally a financial failure. River systems have followed the same laws, their commerce has been confined to the products on their immediate banks, and that of not sufficient amount to justify their permanent improvement. That great waterway, the Mississippi River, has been improved by the General Government and is now being maintained from New Orleans to Cairo at the depth proposed for the Ohio, and for several years has been maintained from Cairo to St. Louis at a depth of 8 feet, yet its commerce is insignificant except what it receives from the unimproved Ohio. The river commerce of St. Louis has declined from 812,185 tons in 1895 to 370,425 tons in 1905, notwithstanding the enormous commercial growth of the city in other directions. The recent railway development from the grain center at Kansas City to the Gulf has diverted a considerable barge commerce from the river to railroad lines by a reduction in rates that the river improvement could not meet.

The Board, however, is of the opinion that conditions are exceptionally favorable for the future development of commerce on the Ohio River. The river now maintains a traffic of over 9,000,000 tons in competition with railways. This commerce appears to be slowly increasing and its growth appears principally in other products than coal.

Pittsburg is the center of vast manufacturing industries and is rapidly developing. Within the Pittsburg district are located 324 factories having water communication either by the Allegheny, Monongahela, or Ohio rivers, and which can as readily ship by water as by rail. The freight entering and departing from this district by river and rail in 1896 was estimated at 60,000,000 tons and in 1906 at from 115,000,000 to 122,000,000 tons. At Pittsburg among the principal manufactured articles are iron and steel ingots, billets, blooms, boilers, structural steel and iron, steel rails, and other material which at other localities become the raw material of their factories. Such items require cheap transportation and will seek a water route if assured of certainty of delivery. Large manufacturing centers also exist at Wheeling, Ironton, and other points on the river. Cincinnati, Louisville, and Evansville are business centers of great activity, and a rapid commercial growth is occurring at St. Louis, Memphis, New Orleans, and other localities on the Mississippi River. The distances

between these localities are sufficiently great to justify a transfer in transit even at considerable expense.

The Board believes that a large commerce is reasonably prospective if these commercial centers are connected by a waterway which will permit the certainty of transportation which is found on existing railroads and that this certainty will be attained by the works proposed in the report.

The General Government has expended large sums in improving the various tributaries of the Ohio. The utility of these improvements is dependent on the navigability of the main stream. The proposed improvement of the Ohio River will create a vast system of water communication penetrating one of the most populous and prosperous sections of the United States. Even in its unimproved condition the river has a marked effect on rail freight rates, the cheap rates quoted in the report as prevailing between New Orleans and Louisville, Cincinnati, and Pittsburg being directly traceable to its influence. Its effect on rail freight rates will be greatly increased if the proposed improvements are carried out.

For these reasons the Board is of the opinion that the improvement of the Ohio River by locks and movable dams so as to secure a depth of 9 feet, as recommended in the report of the special board, is worthy of being undertaken by the United States.

In making this recommendation the Board realizes that it is suggesting a plan for river improvement on a scale not hitherto attempted in this country, but it believes that there will probably be in the near future a popular demand for the improvement of several streams on such a scale. On account of the large commercial development of its shores and its connection with the lower Mississippi now maintained in a navigable condition the Ohio River is, in the opinion of the Board, the one river of all others most likely to justify such work. Furthermore, it should be noted that by authorizing the construction for 9-foot navigation of 14 locks at various parts of the river Congress has already practically entered upon such a system of improvement.

Respectfully submitted.

H. M. ADAMS,
Colonel, Corps of Engineers.
CHAS. E. L. B. DAVIS,
Colonel, Corps of Engineers.
R. L. HOXIE,
Colonel, Corps of Engineers.
C. McD. TOWNSEND,
Lieut. Col., Corps of Engineers.
E. EVELETH WINSLOW,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

OHIO RIVER (GENERAL OPEN-CHANNEL IMPROVEMENT).

This work was commenced by the General Government in 1827, when low-water navigation over many of the bars and shoals was impossible for commercial purposes; but the improvements made and maintained since then have provided fairly convenient channels at such places for a profitable light-draft local freight and passenger service during low-water periods. The difference in level of water surface of the river varies; at Cincinnati, nearly midway between the head and mouth of the river, the average annual range during the past thirty years is 48.4 feet.

The project under which operations have been carried on has been a continuous and progressive one, the principal features of the work being the removal of snags, rocks, and wrecks from the general channel; the direct improvement of bars and shoals, by dredging and rock excavation; the construction, repair, and maintenance of low dikes and dams to concentrate and direct the flow of water in improved channels; bank protection and the construction and repair of levees where required in the interest of navigation; the construction, repair, and maintenance of ice piers and harbors; miscellaneous improve-

ment, including surveys, establishment, care, and record of water gauges, establishment of harbor lines, regulation of encroachment and deposits on the bank of the river or in its channel, and the supervision of construction of bridges across the river. The length of river through which the work extends is but little short of 1,000 miles, and the total expenditure in this district by the Government during the eighty-two years it has been in progress, exclusive of liabilities outstanding June 30, 1909, is $7,168,726.37.

The principal operations of the year were as follows: The U. S. dredges *Ohio* and *Oswego* excavated 215,953 cubic yards of gravel, sand, etc.; 62.8 tons of rock, and 107.85 tons of snags; and the hired dredging plants excavated 80,626 cubic yards of gravel, sand, etc.; 3.75 tons of snags, and 1,100 feet b. m. wreckage. This dredging has resulted in improvement of the channel, making a depth of 5 to 6 feet below low water at Wills Creek, Jonathan Run, Wheeling Creek, Jenny Lind, Connoconneque, and Falling Run bars, Big Blue River Islands, Big Blue River, Fivemile, Fourmile, Peckenpaugh and Fulton bars, Troy reach, The Cabbage Patch, Rockport, Ind., Puppy Creek dike, Yellow Bank Towhead, Head of French Islands, French Islands, Vannada reef, Indian Hill, Flint Island, Evansville Harbor, Henderson dike, Caseyville, Ky., Tradewater and Walkers bars, and Sisters Island.

The installation of boilers, machinery, etc., on the combined hydraulic and grapple dredge *Indiana*, under contract of June 22, 1908, was completed with the exception of the thirty-day trial test, which was prevented by high stage of river. An electric-light plant, the plumbing, etc., and an ice plant were installed, and the necessary outfit, ponton pipe line, etc., purchased.

A contract was entered into on October 6, 1908, for construction of concrete dam at Browns Island; no work was done, but plant is at site ready to begin operation as soon as stage of water permits.

On the concrete dam at head of Marietta Island, under contract dated October 14, 1907, the following work was done and material placed: 9,208.8 cubic yards excavation, 80 cubic yards earth filling, 177 piles, 13,329 pounds of iron tie-rods, etc.; 3,626.46 cubic yards large and 2,827 cubic yards small stone; 2,763.08 cubic yards concrete, and 30½ barrels extra cement.

Repair and bank protection to dikes opposite Evansville, Ind., under contract dated September 22, 1908, was carried on and completed, consisting of the following: 3,310 cubic yards grading, 190 cubic yards riprap stone removed and replaced, 1,413.97 cubic yards new riprap stone placed.

Work of constructing loose stone dike at head of Grand Chain, Ill., under contract of October 14, 1907, was carried on when stage of river permitted, as follows: 3,175 cubic yards of small stone carefully placed and 6,034 cubic yards of small stone roughly placed.

Work on dikes at Mound City, Ill., under contract of June 14, 1905, was carried on and completed. The total work done under this contract is as follows: Small stone, 12,589.042 cubic yards; large stone, 628 cubic yards; excavation, 585 cubic yards.

The work on Great Miami embankment, under contract of December 19, 1907, was carried on and completed. The total work done under this contract is as follows: Earth fill, 20,362 cubic yards; concrete, 19,597¼ square yards.

Supervision was had of established harbor lines at Steubenville, Ohio, Wheeling, W. Va., Ironton, Ohio, and Cincinnati, Ohio. Maps of tentative harbor lines at East Liverpool were prepared and approved and a public hearing ordered, and maps of the Cincinnati harbor lines, showing the location of marking posts and witnesses to the same, were prepared.

Twenty-five permits were issued to cover the construction of gas, water, and oil pipe lines; overhead cables; tramway; intakes; trestle; bank protection; derrick; and pavilion.

Supervision was had of permits for all miscellaneous and bridge constructions below the Pennsylvania state line.

The nature of the Ohio River is such that its improvement, whether by canalization (locks and dams) or open channel, can not bring full benefit to navigation interests until the improvement shall have become more continuous than past appropriations have permitted. The unimproved portions afford less depth of channel than the improved sections and limit the available draft for the whole river to that required for passing its shoalest parts. Dredging and snagging operations will be required at many places, even should a more or less complete system of canalization be finally adopted, and for open-channel improvement continuous work and simultaneous operations will be absolutely necessary to produce effective results. The government plant should be largely increased in order that any great amount of work may be accomplished during the comparatively short periods to which effective operations must be limited each year on account of unfavorable river conditions. Several light-draft tow boats, barges, and derrick boats for dike construction and removing rocks or other obstructions are all urgently needed before anything approximating satisfactory progress can be expected.

The available depth in the Ohio River varies greatly with the fluctuation in river stages. During the fiscal year the available depth has been below the average. This was due, however, to a long-continued drought in the fall of 1908.

The fluctuations in river stages are indicated by the following readings from characteristic river gauges:

	Highest.	Date.	Lowest.	Date.	Range.
	Feet.	1909.	*Feet.*	1908.	*Feet.*
Dam No. 6	32.2	Feb. 25	0.8	Sept. 28, 30	31.4
Wheeling, W. Va	33.9	May 3	.0	Sept. 30–Oct. 9	33.9
Parkersburg, W. Va	36.7	Feb. 27	.0	Sept. 28, Oct. 17–24.	36.7
Point Pleasant, W. Va	42.6	Feb. 27	.2	Oct. 2	42.4
Portsmouth, Ohio	49.8	Mar. 1	1.4	Oct. 4, 5	48.4
Cincinnati, Ohio	54.6	Feb. 28	2.5	Oct. 6, 7	52.1
Louisville, Ky. (head)	39.2	Feb. 27	2.2	Dec. 4	37.0
Evansville, Ind	43.2	Mar. 2	1.3	Oct. 11–16	41.9
Paducah, Ky	44.5	Mar. 5, 6	1.0	Oct. 20	43.5
Cairo, Ill	46.8	Mar. 6	4.3	Oct. 17–19	42.5

The available depth in channel may be considered 1 foot greater than gauge readings from Pittsburg to Louisville and 2 feet greater from Louisville to Cairo.

During the fiscal year no work was done to increase the available depth, but work was confined to the removal of snags and other obstructions and increasing the width of narrow low-water channels, thus bettering navigable conditions.

No estimate can be given of the effect of the improvement thus far made on freight rates. In this connection reference is made to the Report of Ohio River Board (H. Doc. No. 492, 60th Cong., 1st sess.), in which statements are made of present and prospective commerce and the effects of improvements on freight rates, etc.

In order to provide for navigation during comparatively low-water periods in winter, many of the existing dikes and dams will require to be kept in a state of repair, as the movable dams can not safely be operated during a time of even light-running ice, although properly protected steamboats may be able to navigate at such time. The severe losses to floating craft during recent years have shown the importance of maintaining certain of the harbors of refuge afforded by existing ice piers and the providing of others at carefully selected localities.

The commerce of the river during the past year, so far as indicated by statistics that the engineer officer in charge of the river has been able to obtain, was as follows: General merchandise, coal, etc., 8,498,754 tons, at an estimated value of $59,491,278; passengers, 3,960,965.

July 1, 1908, balance unexpended		$582,693.75
Amount allotted from appropriation by river and harbor act approved March 3, 1909		150,000.00
Received from sales, etc		224.92
		732,918.67
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$283,897.25	
For maintenance of improvement	21,760.00	
		305,657.25
July 1, 1909, balance unexpended		427,261.42
July 1, 1909, outstanding liabilities		3,604.74
July 1, 1909, balance available		423,656.68
July 1, 1909, amount covered by uncompleted contracts		90,741.39
Amount (estimated) required for completion of existing project		Indefinite.
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		500,000.00

OHIO RIVER, LOCKS AND DAMS 2, 3, 4, 5, 8, AND 11.

(*a*) *Construction of locks and dams in Ohio River, Pennsylvania (40.5 miles).*—The Ohio River, Pennsylvania, in its original condition had a low-water channel depth varying from 1 foot at Pittsburg to 2 feet at the Ohio state line, the average slope being about 1.25 feet per mile and the minimum discharge at the head about 1,600 cubic feet per second. Under the original project for open-river improvement work was conducted on this portion of the river at a number of shoals.

Under the original project for lock and dam construction, adopted in 1875, Dam No. 1 was begun in 1877 and completed in 1885, at a cost of $940,000. The present project, in its original form, was adopted by Congress September 19, 1890, and, with subsequent modifications, provides for the construction of Locks and movable Dams Nos. 2, 3, 4, 5, 6, and 7, so as to secure a navigable depth of 9 feet in the pools formed thereby, the locks to have available dimensions of 110 by 600 feet. at a total estimated cost of $6,321,376. Appropriations aggre-

gating $5,369,376 have been made, and $15,684.74 has been realized from other sources. The sum of $75,000 additional will be required to place the grounds at Locks Nos. 2–5 in suitable condition.

The amount expended under present project to the close of the fiscal year ending June 30, 1909, was $5,356,309.79.

The work was done partly under continuing-contract system, and the total authorization has been appropriated.

The condition of work on June 30, 1909, was as follows:

Locks and Dams 2, 3, 4, 5, and 6 were all practically completed. The dams were first raised on the following dates: No. 1, October 7, 1885; No. 2, November 12, 1906; No. 3, June 25, 1908; No. 4, June 30, 1908; No. 5, November 21, 1907; No. 6, August 17, 1904.

Lock and Dam No. 7.—The site for this work has been secured and plans are partly made. No field work of construction has been done on account of lack of funds.

The completed dams, Nos. 1–6, inclusive, give continuous slack water, when raised, from Pittsburg to Merrill, Pa., a distance of about 28.9 miles.

The greatest recorded flood height is 34.2 feet at Davis Island dam. Ordinary flood heights average about 28 feet on this portion of the river.

A statement of commerce and of the effect of the project on freight rates, so far as known, is given in the report for operating and care of locks and dams, Ohio River, page 624.

It is proposed to apply the amount estimated as a profitable expenditure for the fiscal year 1911 to the completion of necessary work on the lock grounds at Locks Nos. 2, 3, 4, and 5 ($75,000), which includes filling in the grounds now much below grade and the construction of concrete paving.

The work of constructing Lock and Dam 7 is most urgently needed in order to utilize more effectively the improvements already made on the upper Ohio River, the portion of the river immediately above that location being specially suited for harborage purposes, and it is recommended that authority be given to complete it under the continuing-contract system. No estimate for the existing 6-foot project is included amongst those submitted for the fiscal year 1911, pending action by Congress on the new plans now before it for providing 9-foot navigation (see H. Doc. No. 492, 60th Cong., 1st sess., in which the estimated cost of Dam No. 7 in the 9-foot project is given as $1,094,800).

Reference to more detailed information, reports of surveys, etc., are given on page 522 of the Annual Report of the Chief of Engineers for 1906.

DAMS NOS. 2, 3, 4, AND 5.

July 1, 1908, balance unexpended		$18,919.77
Amount received from sale of condemned property		324.90
Amount received by transfer of public property		250.00
Amount received on account of judgment against E. J. Hingston		5,062.60
		24,557.27
June 30, 1909, amount expended during fiscal year, for works of improvement		2,841.92
July 1, 1909, balance unexpended		21,715.35
July 1, 1909, outstanding liabilities		10.10
July 1, 1909, balance available		$21,705.25

Amount (estimated) required for completion of existing project	75,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	75,000.00

DAM NO. 6.

July 1, 1908, balance unexpended	$8,069.30
June 30, 1909, amount expended during fiscal year, for works of improvement	133.36
July 1, 1909, balance unexpended	7,935.94

DAM NO. 7.

July 1, 1908, balance unexpended	$4,755.38
June 30, 1909, amount expended during fiscal year, for works of improvement	18.18
July 1, 1909, balance unexpended	4,737.20
Amount (estimated) required for completion of existing project	952,000.00

CONSOLIDATED.

July 1, 1908, balance unexpended	$31,744.45
Amount received from sale of condemned property	324.90
Amount received by transfer of public property	250.00
Amount received on account of judgment against E. J. Hingston	5,062.60
	37,381.95
June 30, 1909, amount expended during fiscal year, for works of improvement	2,993.46
July 1, 1909, balance unexpended	34,388.49
July 1, 1909, outstanding liabilities	10.10
July 1, 1909, balance available	34,378.39
Amount (estimated) required for completion of existing project	1,027,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	75,000.00

(*b*) *Locks and dams in Ohio River between the Pennsylvania state line and Cincinnati.*—A general description of the Ohio River is contained in the Annual Report of the Chief of Engineers for 1896, page 2062. The system of improvement of this river by movable dams was approved by Congress in the act of March 3, 1875 (construction of dam at Davis Island—first dam below Pittsburg). The act of September 19, 1890, provided for the construction of a dam at or near Beaver, Pa., known as No. 6. The above represent practically the original projects for the slack-water system of the Ohio. The original project for Dams Nos. 8 to 18, inclusive, is contained in Annual Report of the Chief of Engineers for 1899, page 2361, and and that for dams Nos. 19 and 26 in Annual Report of the Chief of Engineers for 1902, page 1867.

Congress, in the river and harbor act of March 3, 1905, made provision for 9-foot navigation in the pools formed by Dams Nos. 2, 3, 4, 5, and 6, and for an examination of and report on the river by a board of engineers with regard to the method and means of improvement which will meet the demands of traffic, present and prospective. This report is contained in House Document No. 492, Sixtieth Congress, first session.

The river and harbor act of March 2, 1907, made provision for a navigable depth of 9 feet at Dams Nos. 8, 11, 13, 18, and 26, and

for increased cost as follows: Dam No. 8, $1,211,845; Dam No. 11, $1,158,343; Dam No. 13, $1,286,778; Dam No. 18, $933,000; and Dam No. 26, $1,200,000. An increased depth at Dam No. 19 has not been authorized and the estimate of cost remains at $950,000.

When the dams are completed they will provide a navigable depth of 9 feet at intervals between Pittsburg, Pa., and Gallipolis, Ohio.

To carry on the work without interruption, funds should be made available as follows:

At No. 11.—For lock keepers' houses, Poirée dams, dredging, etc. These items can not be provided for from the funds now available.

At No. 19.—For continuing work on dam and constructing lock and guide walls.

At No. 26.—For continuing construction of lock and dam.

DAM NO. 8.

July 1, 1908, balance unexpended	$356,832.54
Amount appropriated by sundry civil act approved March 4, 1909	364,000.00
	720,832.54
June 30, 1909, amount expended during fiscal year, for works of improvement	252,514.96
July 1, 1909, balance unexpended	468,317.58
July 1, 1909, outstanding liabilities	895.58
July 1, 1909, balance available	467,422.00
July 1, 1909, amount covered by uncompleted contracts	67,381.17
Amount (estimated) required for completion of existing project	[a] 65,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	[a] 65,000.00

DAM NO. 11.

July 1, 1908, balance unexpended	$511,356.25
Amount appropriated by sundry civil act approved March 4, 1909	300,000.00
	811,356.25
June 30, 1909, amount expended during fiscal year, for works of improvement	363,121.81
July 1, 1909, balance unexpended	448,234.44
July 1, 1909, outstanding liabilities	936.62
July 1, 1909, balance available	447,297.82
July 1, 1909, amount covered by uncompleted contracts	86,956.64
Amount (estimated) required for completion of existing project	[b] 74,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	[b] 74,000.00

[a] Due to the fact that, since the date of preparing this estimate and submitting the same to the Secretary of War, favorable bids have been received for certain parts of this dam, more work can be undertaken with the funds now available, and it is believed that further appropriation for Dam No. 8 is no longer necessary.

[b] Due to the fact that, since the date of preparing this estimate and submitting the same to the Secretary of War, favorable bids have been received for certain parts of this dam, more work can be undertaken with the funds now available, and it is believed that the amount of this estimate for further appropriation for Dam No. 11 may be reduced to $48,000.

DAM NO. 13.

July 1, 1908, balance unexpended	$314,050.56
Amount transferred from allotment for dam No. 18	6,000.00
Amount appropriated by sundry civil act approved March 4, 1909	160,000.00
	480,050.56
June 30, 1909, amount expended during fiscal year, for works of improvement	331,458.64
July 1, 1909, balance unexpended	148,591.92
July 1, 1909, outstanding liabilities	1,987.26
July 1, 1909, balance available	146,604.66
July 1, 1909, amount covered by uncompleted contracts	4,665.70
Amount (estimated) required for completion of existing project	(a)

DAM NO. 18.

July 1, 1908, balance unexpended	$293,648.33
Amount transferred to allotment for Dam No. 13	6,000.00
	287,648.33
Amount appropriated by sundry civil act approved March 4, 1909	60,000.00
Amount received from sales	1,337.93
	348,986.26
June 30, 1909, amount expended during fiscal year, for works of improvement	229,821.88
July 1, 1909, balance unexpended	119,164.38
July 1, 1909, outstanding liabilities	2,998.42
July 1, 1909, balance available	116,165.96
July 1, 1909, amount covered by uncompleted contracts	26,264.95
Amount (estimated) required for completion of existing project	(a)

DAM NO. 19.

July 1, 1908, balance unexpended	$206,128.68
Amount received from sale	252.90
	206,381.58
June 30, 1909, amount expended during fiscal year, for works of improvement	35,135.88
July 1, 1909, balance unexpended	171,245.70
July 1, 1909, outstanding liabilities	764.08
July 1, 1909, balance available	170,481.62
July 1, 1909, amount covered by uncompleted contracts	111,305.00
Amount (estimated) required for completion of existing project	725,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	400,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

DAM NO. 26.

July 1, 1908, balance unexpended	$326,025.93
Amount appropriated by sundry civil act approved March 4, 1909	300,000.00
	626,025.93
June 30, 1909, amount expended during fiscal year, for works of improvement	92,925.28

[a] The balance of the continuing-contract authorization for Locks and Dams Nos. 13 and 18 is $175,000; but it is now expected to complete these works with the funds available without further appropriations.

July 1, 1909, balance unexpended	$533,100.65
July 1, 1909, outstanding liabilities	10,956.66
July 1, 1909, balance available	522,143.99
July 1, 1909, amount covered by uncompleted contracts	53,206.43
Amount (estimated) required for completion of existing project	555,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for work of improvement, exclusive of the balance unexpended July 1, 1909	300,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

CONSOLIDATED.

July 1, 1908, balance unexpended	$2,008,042.29
Amount received from sales	1,590.83
Amount appropriated by sundry civil act approved March 4, 1909	1,184,000.00
	3,193,633.12
June 30, 1909, amount expended during fiscal year, for works of improvement	1,304,978.45
uly 1, 1909, balance unexpended	1,888,654.67
July 1, 1909, outstanding liabilities	18,538.62
July 1, 1909, balance available	1,870,116.05
July 1, 1909, amount covered by uncompleted contracts	349,779.89
Amount (estimated) required for completion of existing project	1,594,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	[a] 839,000.00

ALPENA HARBOR (THUNDER BAY RIVER), MICHIGAN.

The original depth of water over the bar at the mouth of the Thunder Bay River was only 7 feet. Local enterprise had secured a narrow channel 12 feet deep through the bar before work was undertaken by the Government in 1877, when, under the original project for the improvement of this harbor, act of August 14, 1876, a channel 13 feet deep and 200 feet wide was secured at a cost of $4,390.48. Shoaling having occurred, in 1882 $15,000 was appropriated for redredging the channel, and the project was modified so as to provide for an available depth of 14 feet. The work was completed the following year at a cost of $10,500, and $3,998.22 was expended in 1889 in redredging to 14 feet across the bar and 13 feet upstream. The amount expended on this project was $14,498.22.

In 1890 the present project was adopted so as to provide for a channel depth of 16 feet below the datum plane 581.5 and the extension of the improvement up the river about a mile to the vicinity of the dam across the river at that point, with widths varying as follows: 200 feet at the 16-foot contour in Thunder Bay, thence tapering to 100 feet at the light-house crib, thence 100 feet to the Second Street Drawbridge, thence 75 feet to the Minor Lumber Company's wharf, thence 50 feet to the upstream limit of the channel improvement, the estimated cost being $36,087.48. This project was completed in 1893. The channel was redredged in 1899, and again in the summer of 1907, a 16-foot depth being provided with a width of 140 feet

[a] Due to the fact that, since the date of preparing this estimate and submitting the same to the Secretary of War, favorable bids have been received for certain parts of Dams Nos. 8 and 11, more work can be undertaken with the funds now available, and it is believed that this estimate of $839,000 may be reduced to $748,000.

opposite the light-house, tapering to 100 feet at Second Street Bridge, and to 60 feet for a farther distance of 2,100 feet.

The amount expended on the work of the existing project to the close of the fiscal year ending June 30, 1909, is $36,215.86, of which amount $14,915.39 has been applied to maintenance.

The total length of dredged channel is 6,550 feet, a channel 2,250 feet long and 100 to 200 feet wide having been secured in Thunder Bay, and 4,300 feet long in the river, with widths varying from 100 feet at the light-house crib to 50 feet at the upstream limit of the improved channel. The maximum draft that can be carried over the shoalest part of the channel June 30, 1909, is 13.5 feet. The river is navigable to the upper limit of the improvement only, farther navigation being interrupted by the dam across the river at that point.

The piers at Alpena have been constructed of slabs and have heretofore been held in position by heavy piles of lumber. The timber of this section of the country is rapidly being cut away and the lumber stored is diminishing. As the lumber piles are removed it will be necessary to add sufficient riprap to the outer ends of the slab piers to prevent their destruction by wave action in Thunder Bay. The removal of the lumber is, however, believed to be gradual, and the appropriation recommended is for the purpose of maintaining the piers and any dredging that may be necessary.

The commerce of the harbor consists mainly of lumber, stone, cement, coal, cedar posts and ties, hay and feed, and general merchandise, and amounted to a total of 269,798 tons during the year 1908, valued approximately at $1,913,762.

The effect of the improvement upon freight rates has been very beneficial, as it is estimated that freight and passenger rates have decreased almost one-half since the improvements were made.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1893	51,600	308,988	1901	62,131	169,442
1894	102,700	363,291	1902	60,213	193,201
1895	35,957	269,203	1903	69,721	153,222
1896	94,067	255,687	1904	51,722	150,381
1897	78,378	293,161	1905	73,331	200,785
1898	60,300	236,075	1906	78,241	171,185
1899	27,888	197,725	1907	419,403	166,116
1900	51,653	263,702	1908	42,035	227,763

July 1, 1908, balance unexpended	$410.00
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	14.56
July 1, 1909, balance unexpended	395.44
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	5,000.00

GRAND HAVEN HARBOR, MICHIGAN.

This harbor is at the mouth of Grand River, the largest river in the State of Michigan. Before any work had been done the natural depth at the mouth of the river varied from 9 to 12 feet, with greater depths in the inner reaches.

In 1857 the Detroit and Milwaukee Railroad Company (Grand Trunk), whose western terminus is at the town of Grand Haven, built a pile pier 3,185 feet long upon the south side of the entrance, and also revetted, by means of close piles, portions of the bank upon the north side of the river. In 1866, when work by the United States was begun, the pile pier had been partly destroyed by fire and by storms. The available depth was 13 feet.

The present project was adopted in 1866 and amended in 1868, 1880, 1890, and 1892. It provides for the construction of parallel piers and revetments 400 feet apart, with the object of creating an entrance channel 18 feet deep at an estimated cost of $804,366.15. The amendments to the original project did not materially change its original purpose, the changes being principally in the proposed length of the piers and revetments.

To June 30, 1909, there had been expended upon the existing project the sum of $881,068.12, of which $542,976.82 was for construction and $338,091.30 for maintenance.

Operations during the fiscal year have been for maintenance. The south pier between stations 7+07 E and 6+04 W was substantially repaired by contract, the work being completed June 25. Some minor repairs by day labor were made to damaged portions of the two piers. Under an emergency contract, work on refilling with stone parts of the two piers and riprapping the interior portion of the south revetment was begun in November and will be completed in July, 1909. From October 19 to 22, December 14 to 17, and again January 18 to 28, the government dredge deepened the channel across the outer bar and also widened the river channel opposite the Grand Trunk Railway dock, removing a total of 34,221 cubic yards of sand.

The proportion of the approved project completed to June 30, 1909, is 93 per cent, the linear extent of the structures so far built being 3,538 feet in the north pier and 5,774 feet in the south pier. The available depths on June 12–19 were 18.9 feet in front of and 21.6 feet in the southern approach to the entrance outside, 18.6 feet between the outer end of the piers and 20 feet inside.

Even when there is no extraordinary freshet in Grand River, a central bar persists in forming from year to year beyond the entrance to this fine harbor and seriously impairs its usefulness. Consequently it is fortunate that there is a government dredge at hand to promptly furnish relief at any time.

In order to complete the project 250 feet of pier extensions are required at an estimated cost of $40,000.

This harbor has for years been one of considerable importance. It is the western terminus of the Detroit, Grand Haven and Milwaukee branch of the Grand Trunk Railroad, in connection with which is run throughout the year two lines of steamers to Milwaukee. In addition there is one line with regular and frequent scheduled trips to Chicago. All three lines do a large passenger and a very considerable freight business, especially during the season of fair weather.

The water-borne commerce at this port is mostly general in character, and has increased from 1,151 arrivals and departures with 155,854 short tons in 1900, to 1,538 arrivals and departures with 437,625 short tons of cargo, valued at $60,670,000, in 1908. The local freight rates from Grand Haven to Chicago by vessel are about 14 per cent lower than the corresponding rates by railroad.

Of the available balance $12,000 should be reserved for dredging by the *Gillespie* in 1909, 1910, and 1911, leaving about $115,000 available for repairing portions of the two piers, which are in very bad condition. The cost of completing this repair work was estimated, on page 2043 of the Annual Report of the Chief of Engineers for 1908, at $168,000. This harbor is one of considerable importance and the structures should be made thoroughly safe. Accordingly, it is estimated that the difference between the amount now available for repairs and the above estimated total cost, namely, $53,000, should be appropriated for the fiscal year ending June 30, 1911. No estimate is submitted for pier extension, as at present it does not appear to be necessary, and by proper use of the dredge *Gillespie* may perhaps be avoided altogether.

The latest map of this harbor is found in the Annual Report of the Chief of Engineers for 1890, page 2650.

The effect of the project on freight rates is at least the reduction of 14 per cent noted above.

Report upon a preliminary examination of "Grand Haven Harbor to east end of Fulton street, and including channel into Spring Lake" was made by the district officer under date of May 31, 1909, in accordance with the requirements of the act of Congress approved March 3, 1909. This report will be submitted to Congress at the second session, Sixty-first Congress:

July 1, 1908, balance unexpended	$69,018.80
Amount allotted from appropriation by river and harbor act approved March 3, 1909	100,000.00
	169,018.80
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	25,143.85
July 1, 1909, balance unexpended	143,874.95
July 1, 1909, outstanding liabilities	162.15
July 1, 1909, balance available	143,712.80
July 1, 1909, amount covered by uncompleted contracts	14,480.53
Amount (estimated) required for completion of existing project	40,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	53,000.00

HARBOR OF REFUGE AT GRAND MARIAS, MICH.

Originally the entrance to this harbor was obstructed by a bar having but 9 feet depth of water upon it at low water. The project for its improvement, adopted August 5, 1881, and modified December 21, 1894, has for its object a deep and safe channel into the harbor, making it a harbor of refuge. This object is to be attained by building parallel piers, 500 feet apart, projecting into the lake to a depth of 22 feet, and dredging out an 18-foot channel between them, connecting the deep water of the lake with that of the harbor, and by closing up the natural entrance, 5,770 feet in width, by a solid pile dike, driven with a slope toward the waves and strongly braced. The proposed length of each pier was 1,800 feet. The estimated cost of the entire project was $484,000. The west pier has now reached a length of 1,912 feet, the east pier 1,545 feet, and the pile dike is completed.

This dike was built in 1895–1897 to close the natural entrance, to protect the harbor from storms, and prevent the movement of sand

into the harbor. The expected formation of a sand beach along the line of the dike is partially realized, but much of the dike is still exposed to the heavy seas and to damage by ice.

The amount expended on the project up to the close of the fiscal year ending June 30, 1909, not including outstanding liabilities, was $468,979.73, of which $113,094.44 was expended for maintenance.

About 3,600 feet of the pile dike was repaired and strengthened between September 1, 1904, and August 6, 1906, under two contracts, at a total cost (including administration) of nearly $54,000.

It is hoped that no further work than this will be necessary on the dike, but it is possible that the riprap will settle into the sand bottom by the action of waves and require additional rock.

Dredging was done in July and August, 1908, for removing shoals from the entrance channel, to the amount of 93,933 yards, at 18¾ cents, or $17,612, which gave a depth of 18 to 21 feet at mean low water and a width of 200 to 300 feet. Repairs to the entrance piers were made in May and June, 1909, at a cost of $484.49, and some extensions to the sand fences west of the entrance were made at nominal cost. (Details in Appendix I I 10, of this report.)

The usual variation of water level extends from 0 to +1 foot above low-water datum.

In front of the entrance to the harbor the 22-foot curve of depth has advanced lakeward between 500 and 600 feet since the project for improvement was adopted, and this fact will entail some additional expense for pier extension to deep water. This would now require an addition of 450 feet to the west pier and 794 feet to the east pier. This would bring the total cost of these extensions up to $149,280—about $103,879 more than the original estimate. It is hoped, however, that the original estimate will finish the west pier. This would stop the movement of sand from the west into the channel, and it is possible that the extension of the east pier would not then be necessary.

The commerce of this port has increased from 1,910 tons in 1887 to 1,769 arrivals and clearances, with 54,525 short tons of freight, valued at $2,539,780, in 1907. In 1908 there were 874 arrivals and clearances, with 45,006 short tons, valued at $1,319,658, showing a decrease of 17 per cent in freight and 48 per cent in valuation from 1907.

The total commerce from 1880 to 1908, inclusive, is estimated at 1,435,790 short tons, valued at $24,357,304.

The total expenditures by the Government for this harbor to date are nearly 2 per cent of the value of the vessel freight received and shipped during the period covered by these expenditures.

The annual expense of government operations at this harbor, consisting of maintenance, interest, and depreciation, is approximately $25,253. This amounts to $0.56 per ton of vessel freight for the year 1908, also to about 2 per cent of the value of this freight, and is about 29 per cent of the saving in the cost of transportation on this freight by water as compared with rail rates.

Effect of project on freight rates: Estimated saving by water transportation as against rail, $1.94 per ton, amounting to $87,312 for the lake commerce of 1908. With the original condition of the harbor this shipping could not have been carried on, and the above-mentioned saving in cost of transportation is a result of the project for improvement.

It is proposed to expend $8,599 of the available balance, together with the sum recommended for works of improvement ($45,401.68), making $54,000, in building the west pier of the entrance out to the 22-foot depth of water, a distance of 450 feet. The remainder of the available balance, together with the sum of $40,000 estimated for maintenance of improvement, will be expended for repairs to piers and the dike and for dredging, as occasion requires.

July 1, 1908, balance unexpended	$36,890.96
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	20,147.37
July 1, 1909, balance unexpended	16,743.59
Amount (estimated) required for completion of existing project	45,401.68
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	[a] 85,400.00

HARBOR OF REFUGE AT HARBOR BEACH, LAKE HURON, MICHIGAN.

The site for this harbor, selected in 1872 by a Board of Engineer officers, is on the west short of Lake Huron, 60 miles north of its outlet into the St. Clair River, and the artificial harbor built there since then is the only safe refuge on that coast from the foot of the lake to Tawas Bay, 115 miles above.

The work of construction was commenced in 1873 under a project providing for three separate piers, or breakwaters, of cribwork filled with stone, so located as to shelter a water area of some 650 acres on the north, northwest, and west sides, and for deepening this area by dredging where necessary. The estimated cost of the breakwaters was $1,452,550, and they were completed in 1885 at a cost of $970,716.40, including maintenance to that date.

The river and harbor act of March 3, 1899, provided for commencing the work of rebuilding the superstructure of the main pier in concrete, and authorized the work to be inaugurated under the continuing-contract system to the extent of $200,000. It was not, however, until 1903 that a definite project for doing the work was decided upon, and the first contract was let in August of that year. The work was begun in June, 1904.

The river and harbor act of March 3, 1905, directed an examination to be made of the harbor, with a view to ascertaining what other further improvements were necessary, if any, in order to make such harbor of refuge suitable for the present demands of commerce. The report, which was submitted to Congress June 16, 1906, and printed as House Document No. 900, Fifty-ninth Congress, first session, recommended the continuation of the rebuilding of the superstructure of the main pier as begun, the rebuilding of the superstructure of the north and south piers in concrete, the protection of the main pier from wave shock by riprap, the closing of the north entrance to pre-

[a] Since the preparation of this estimate, further consideration of existing conditions leads to the conclusion that possibly the project depth of 18 feet may be as efficiently and more economically maintained by dredging alone than by further extension of the piers. Hence, it is believed that this estimate may be reduced to $40,000 for maintenance only, leaving the question of extending the piers to be determined after further experience.

vent the entrance of littoral deposit, and the dredging and deepening of the harbor to 21 feet and of the main entrance to 23 feet. The estimate for the work recommended was $970,000, with an added sum of $10,000 per year for maintenance and harbor police. By the river and harbor act of March 2, 1907, $150,000 was appropriated for continuing this work.

Under this plan for the repair and improvement of the harbor, work on the main pier has been carried on continuously, and was completed in September, 1908.

The total amount expended to the close of the fiscal year ending June 30, 1909, is $1,899,347.89, of which about $975,000 was applied to the first cost of the sheltering breakwaters, which were completed in 1885. Since that time there has been applied to maintenance $924,347.89, which includes the construction of concrete superstructure on main pier, the keeping of the wooden piers in repair, dredging within the harbor, control and berthing of vessels entering the harbor for shelter, and engineering supervision and general office expenses.

The available balance will be applied to covering the cost of the necessary supervision of the harbor during the ensuing fiscal year; also to such repairs to the timber structures as may become necessary.

As a result of the expenditures made upon this harbor, there has been created an artificial harbor of refuge, which has been used for shelter during the past year by 697 vessels, with a total tonnage of 610,886 tons. The grand total of vessels that have found shelter from 1877 to 1908, inclusive, is 37,464, the tonnage of which aggregated 16,583,758. The vessels sheltered in 1877 averaged 289 tons each, and those during the year 1908, 885 tons. The maximum draft that can be carried into the harbor through the main entrance, making allowance for the effect of moderate seas, is between 19 and 20 feet, and vessels having this draft may safely lie inside the main pier.

The appropriation recommended will be applied to continuing reconstruction of the piers.

July 1, 1908, balance unexpended	$121,616.88
Amount allotted from appropriation by river and harbor act approved March 3, 1909	10,000.00
	131,616.88
June 30, 1909, amount expendedduring fiscal year, for maintenance of improvement	104,597.56
July 1, 1909, balance unexpended	27,019.32
July 1, 1909, outstanding liabilities	10,689.00
July 1, 1909, balance available	16,330.32
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	275,000.00

HOLLAND HARBOR, MICHIGAN.

When improvement was begun in August, 1867, by the United States, there existed a narrow channel 5½ feet deep between piers built of brush and of irregular cribs. These had been constructed by the harbor commissioners of the adjoining town of Holland.

A project was adopted in 1867 and amended in 1873, 1879, 1884, and 1892, this project providing in general terms for a channel 12 feet

deep between piers and revetments 160 feet to 213 feet apart. From 1867 to 1880 there were built by the United States piers and revetments aggregating 1,854 feet on the north side and 1,691 feet on the south side. Since the latter date there have been no additions to these structures, except, in 1889, a length of 160 feet of pile pier on the south side, designed to close a gap in the existing structure. Upon this project there was expended up to March 3, 1899, $304,217.30, of which $127,597.50 was for maintenance. The end cribs of the piers were wrecked by storms and they were removed in September, 1908. As a result, the length of the north pier at present is 1,808 feet and that of the south pier 1,639 feet.

The present project was adopted in 1905 and modified in 1907. It provides for a channel 16 feet deep, protected on the outside by two converging piers 300 feet apart at the outer end and 740 feet apart at the inner end, and on the inside by piers and revetments having a clear distance of about 205 feet at the outer end and of 162 feet at the narrowest place inside, the inner ends of the converging portions to be connected with the old piers of the inner channel by stone-filled pile structures. The project also provided for extensive repairs of the existing works. The estimated cost was $240,000.

From March 3, 1899, the date of adoption, to June 30, 1909, there was expended on this project and its modifications $381,932.08, of which $93,799.71 was for maintenance.

The operations during the fiscal year were as follows: Under the continuing contract of October 11, 1905, the construction of the two converging pier extensions, 750 feet in length on the north side and 800 feet on the south side, was completed, as also the connecting pile structures at their inner ends, with the exception of a small amount of stone filling. The reconstruction of the interior north pier from the shore line to the angle and the repairs of the south pier from the shore line to the inner end were also completed, and the repairs of about 340 feet of the outer portion of the interior south pier are fairly well advanced. All the above comes under the head of new work under the present project. Under the head of maintenance, the wrecked cribs at the outer end of the interior piers were removed and the new ends of the piers were strengthened and protected with round piles, connected by means of wales and screw bolts with the main structures. The channel at the entrance and between the interior piers to Black Lake was dredged July 29–31, September 21–23, November 24 to December 31, and again March 19 to April 26, the total quantity of material removed measuring 99,846 cubic yards. All the funds required for the completion of the continuing contract have been appropriated.

The approved project was very nearly completed on June 30, 1909.

The uncompleted condition of the piers and revetments has heretofore interfered seriously with the maintenance of the required depth, but better results may be expected hereafter. The maximum draft upon the completion of dredging in April was 18.4 feet, and at the end of the fiscal year 17 feet.

This harbor is relatively an important one, being the terminus of one of the lines of and one of the principal stations of the main line of the Pere Marquette Railroad Company and the terminus of the Grand Rapids, Holland and Chicago Electric Railway, which here connect with a line of steamers. These during the season of naviga-

tion, when the condition of the harbor permits, run regularly to Chicago. The passenger business is especially important, but there is also profitable freight traffic.

The vessel freight of this harbor has increased from 678 arrivals and departures, with 16,430 short tons, in 1903, to 830 arrivals and departures, with 165,155 short tons, valued at $53,480,000, in 1908. The total number of passengers carried in 1908 was 86,700. The commerce at this port is both general and local. Vessel freight rates to and from Chicago are about 14 per cent less than the corresponding railroad rates.

The balance available after paying all contract liabilities and contingencies will be about $30,000, of which $14,000 should be reserved for maintenance by dredging and general repairs until June 30, 1911. Past experience has shown that the converging or outer portions of the piers are liable to damage by storms, and that precautions should be taken to insure a permanent supply of riprap along them. Originally these piers were protected with about 2,000 cords of riprap, which was specified to weigh not less than 500 pounds, and presumably it weighed little more than this. For effective protection riprap should weigh from 3 to 10 tons, and will then be correspondingly more difficult and expensive to place. Assuming that 2,000 cords of additional riprap may be needed, this will probably cost close to $20 per cord, or $40,000 in all, and therefore an additional appropriation of $24,000 is estimated as needed for the fiscal year ending June 30, 1911, to be charged to maintenance.

The report upon which the present project is based is published in full in the Annual Report of the Chief of Engineers for 1897, pages 2950, 2951; and the Annual Report for 1905, pages 2176, 2177, contains a drawing and description of the adopted plan.

Information as to the effect of the improvement on freight rates is difficult to obtain, but it is certainly not less than a reduction of 14 per cent, and may be more than this.

July 1, 1908, balance unexpended		$173,102.89
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$100,796.24	
For maintenance of improvement	14,589.91	
		115,386.15
July 1, 1909, balance unexpended		57,716.74
July 1, 1909, outstanding liabilities		754.67
July 1, 1909, balance available		56,962.07
July 1, 1909, amount covered by uncompleted contracts		25,080.10
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		24,000.00

LUDINGTON HARBOR, MICHIGAN.

This harbor is the outlet of Pere Marquette River, which expands into Pere Marquette Lake before emptying into Lake Michigan. In 1867, before improvement was begun by the United States, the outlet from Pere Marquette Lake to Lake Michigan had a length of 830 feet, protected by diverging slab piers. The entering depth was 7 to 8 feet.

The former project was adopted in 1867 and modified in 1885, 1889, 1890, and 1899. In its final form, as adopted by the river and harbor act of March 3, 1899, it provided for a through channel 183 to 285 feet wide and 18 feet deep, protected by the requisite piers and revetments. The estimated amount required to complete the revised project was $210,000. The development of the harbor has been progressive, the changes in the original project affecting only the length of the piers, their direction, and the depth between them. It may therefore be said that the estimated cost of completion of that project is really the sum of the above amount and that previously expended, or $591,055.91 in all.

To June 30, 1909, the sum of $712,698.78 was expended upon the original project and its subsequent modifications. Of the above, $579,870.79 was expended for construction and $132,827.99 for maintenance. As a result of the above expenditure there now exists a reasonably reliable 18-foot channel, protected by piers and revetments. Annual dredging is necessary, however, to maintain a channel 18 feet in depth and of sufficient width.

The present project, as adopted by the act of Congress of March 2, 1907, provides for an interior channel 18 feet deep, protected by piers and revetments, and for an exterior basin, to be formed by two breakwaters of crib construction, each 1,800 feet long, 400 feet apart at the outer ends, and diverging at an angle of 90 degrees, the inner ends of the breakwaters to be connected with the shore by suitable structures. The estimated cost of this project was $839,087. A continuing contract for the construction of the breakwaters, not including the shore connections, was entered into under date of December 10, 1907, the remaining work to be placed under contract at a later date.

The amount expended under the present project to June 30, 1909, was $88,454.57, all of which was for new work.

Under the continuing contract the following work was done during the fiscal year: For the south breakwater five additional cribs, each 100 feet long, were built, six cribs were sunk on their pile foundations, and the superstructure was completed for a length of 343 feet. For the north breakwater the construction of four cribs was completed, two cribs were sunk, and the construction of the superstructure was begun. Under the head of maintenance, the damaged inner end of the north pier was repaired, and 590 linear feet of that pier was strengthened with additional piles. The filling in parts of the south pier was replenished. The channel between the piers was deepened October 16–17 and again May 5–7 and May 17–19 by the government dredge, the total quantity dredged being 14,830 yards. The dredging in May was occasioned by the grounding on May 3 of the deep-draft coal barge *New York*. The *Gillespie* was at once ordered to Ludington and the barge was released May 5.

The existing project gives authority for entering into continuing contracts to complete the improvement at a cost not to exceed $839,087, of which amount $519,087 remains to be appropriated.

The original project for the interior harbor is completed. The proportion of the project of 1907 completed to June 30, 1909, is 16 per cent. The maximum draft that could be carried at the end of the fiscal year was 19 feet.

The water-borne commerce at this harbor has averaged for the last ten years 1,329,878 short tons, and in 1908 it consisted of 3,528 entrances and clearances, with 1,416,560 short tons of cargo, valued at $149,553,000, and was general in character. The local freight rates by vessel to Chicago are about 29 per cent less than the corresponding rates by railroad.

Excluding contract obligations, but including the allotment of $8,000 from the appropriation of the act of March 3, 1909, there is at present available a total of $9,161.84, besides the amount necessarily reserved for contingencies, and this amount is sufficient to pay for needed dredging and incidental repairs during the remainder of 1909 and in 1910. During the fiscal year ending June 30, 1911, there may be profitably expended the following:

For continuing improvement, as authorized, under continuing contract	$300,000
For maintenance by dredging	5,000
For maintenance, incidental repairs, and contingencies	5,000
Total	310,000

The report upon which the project of 1907 is based is printed in House Document No. 62, Fifty-ninth Congress, first session.

This harbor is one terminus of the main line of the Pere Marquette Railroad Company, which operates lines of car ferries from this point to Manitowoc, Wis., and Milwaukee, Wis. Lines of passenger and package freight steamers also make regular sailings to Milwaukee and Chicago. The business done by the car-ferry lines is of enormous and constantly increasing importance in its effect upon freight rates to and from the Northwest. It is desirable to give to the car-ferry service the same assurance of regularity of schedule as exists in the case of the ordinary railroad lines. At present difficulty is usually experienced in the fall and winter months, due to the narrowing of the channel by a shoal from the north. The car ferries are large and unwieldy and require ample sea room. A narrow channel is therefore impracticable, and to insure safety and regularity to the service repeated dredging is necessary, for which the United States seagoing hydraulic dredge is now available.

The effect of the improvement has been to create a class of traffic which, in the absence of a deep and readily available channel, could never have existed. There has thus been provided a shorter route for the products of the upper Mississippi Valley, which has the additional merit of avoiding the congestion usually existing on the railroads at the south shore of Lake Michigan. Freight rates are believed to have been materially reduced by this route.

July 1, 1908, balance unexpended		$161,731.67
Amount allotted from appropriation by river and harbor act of March 3, 1909		8,000.00
Amount appropriated by sundry civil act approved March 4, 1909		200,000.00
		369,731.67
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$87,428.06	
For maintenance of improvement	3,567.87	
		90,995.93
July 1, 1909, balance unexpended		278,735.74
July 1, 1909, outstanding liabilities		500.15
July 1, 1909, balance available		278,235.59

July 1, 1909, amount covered by uncompleted contracts		$251,560.11
Amount (estimated) required for completion of existing project		519,087.00
Amount that can be profitable expended in fiscal year ending June 30, 1911, exclusive of the balance unexpended July 1, 1909:		
For works of improvement	$300,000.00	
For maintenance of improvement	10,000.00	
		310,000.00

MACKINAC HARBOR, MICHIGAN.

Following is the letter of the Chief of Engineers submitting report of survey, printed in House Document No. 646, Fifth-sixth Congress, first session, and also in report of Chief of Engineers, 1900, part 6, page 4008:

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, April 25, 1900.

SIR: I have the honor to submit herewith copies of reports dated May 15, 1899, and April 20, 1900, with map, by Lieut. Col. G. J. Lydecker, Corps of Engineers, upon preliminary examination and survey, respectively, of Mackinac Harbor, Michigan, for the protection of the harbor by breakwaters.

The project presented provides for construction of two breakwaters, one to extend out from Biddle Point, the other to extend out from Mission Point, as indicated on the map, the estimated cost of both being $80,000, and Colonel Lydecker states that the harbor is worthy of improvement to this extent.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers, U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

MANISTEE HARBOR, MICHIGAN.

In 1866, previous to the beginning of work by the United States, the entrance to this harbor was improved by slab piers, 100 to 150 feet apart, built by local enterprise, a navigable depth of 7 to 8 feet being thereby maintained.

The project adopted in 1867 and amended in 1871, 1873, 1875, 1884, 1890, and 1892 provides for a channel of navigable width with a depth of 15 feet, extending from Lake Michigan to Manistee Lake, protected by piers and revetments at the entrance. The various modifications of the original project merely extended its limits, changed the proposed length of the piers, and the proposed depth from 12 to 15 feet. Operations have been progressive, and no work under any project not essential to its final form has been done.

To June 30, 1909, there has been expended $448,614.40, of which $329,996.18 was for construction and $118,618.22 for maintenance.

As a result of the above total expenditure to June 30, 1909, there had been built 2,906 linear feet of north and 1,450 linear feet of south pier and revetment, the width between the piers varying between 150 feet inside and 190 feet at the outer end of the south pier, which is 250 feet shorter than the north pier. The portion of the north revetment occupied by the Manistee and Northeastern Railroad Company, referred to in the Annual Report of the Chief of Engineers for 1899, page 2940, still remains without repairs.

The act approved March 2, 1907, changed the project by providing for improvement in accordance with the report submitted

in House Document No. 511, Fifty-ninth Congress, first session, which contemplates securing a uniform depth of 18 feet, by dredging to a depth of 20 feet, pier extension, revetment, and protection works, at an estimated cost of $147,488, provided satisfactory pledge is given that certain private and municipal work will be completed within a reasonable time, that land for the improvement will be donated, and that the United States will be protected from claims for damages which may result from the work. No expenditures have yet been incurred on account of the modified project, approved March 2, 1907.

The following is a summary of the operations during the past fiscal year: Dredging under contract for widening the channel in the river, begun June 22, 1908, was completed July 11, and the channel at the entrance and through the outer bar was deepened November 12–23 by the *Gillespie* to 20 feet. Under an emergency contract, dated July 1, parts of the two piers were refilled with stone, and on May 20 operations under contract were begun for thoroughly repairing the north pier between stations 7+69 and 12+38.7. All these operations come under the head of maintenance.

Of the original project 95 per cent is completed, and, as already stated, no work has yet been done upon the modified project of 1907. The maximum draft which on June 30, 1909, could be carried was 15 feet.

The vessel commerce at this port for the last ten years has averaged 526,956 short tons, and in 1908 it amounted to 2,116 entrances and clearances with 428,084 short tons of cargo, valued at $17,411,000, principally local in character. Definite information as to the effect of the improvement upon freight rates could not be obtained, but the local freight rates by vessel from Manistee to Chicago are about 30 per cent less than the corresponding rates by railroad.

As the conditions precedent to beginning work under the project of 1907 have not yet been met, the project of 1892 remains in force. After deducting outstanding obligations and contingencies, a balance of $11,228.44 remains available, which will permit dredging at the entrance by the *Gillespie* during two seasons and additional repairs when required.

During the year ending June 30, 1911, there may profitably be expended for maintenance of improvement the following:

For repair of outer end of north pier	$2,000
For incidental repairs	5,000
For dredging at entrance by *Gillespie*	5,000
For dredging in upper reaches of channel by contract	10,000
Total	22,000

The commerce tributary to this harbor is derived principally from the salt and lumber industries. The harbor is also a regular port of call for one line of steamers plying from Chicago to points upon the east shore of Lake Michigan, and a single steamer makes stated trips from Manistee to Milwaukee. There are three railroads running into Manistee, the Pere Marquette, the Manistee and Grand Rapids, and the Manistee and Northeastern.

July 1, 1908, balance unexpended	$29,549.27
June 30, 1909, amount expended during fiscal year for maintenance of improvement	6,138.80
July 1, 1909, balance unexpended	23,410.47
July 1, 1909, outstanding liabilities	120.25
July 1, 1909, balance available	23,290.22
July 1, 1909, amount covered by uncompleted contracts	10,604.86
Amount (estimated) required for completion of existing project	122,488.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	22,000.00

MANISTIQUE HARBOR, MICHIGAN.

The original depth at the mouth of the Manistique River was 8 feet. By private enterprise 3,000 linear feet of slab piers had been built and a channel dredged to a depth of 11 feet before any appropriation was made by the Government.

The original project, adopted in 1880, provided for increasing the depth of the channel to 13 feet below datum for a width of 150 feet by dredging. The amount expended on this project was $3,955.05.

The present project was adopted by the river and harbor act of March 3, 1905, and provided for pier construction, breakwater extension, and dredging to a depth of 19 feet below datum; estimated cost, $270,000 (see Annual Report of the Chief of Engineers for 1905, p. 525).

In accordance with a provision in the river and harbor act of March 2, 1907, a modification of this project was approved by the Secretary of War April 3, 1908. The modification consists mainly in swinging the inner end of the proposed west pier to the westward, thereby providing a stilling basin, and in extending the east breakwater about 90 feet farther westward than at first provided; estimated cost, $338,462.

Neither of the foregoing estimates includes the acquisition of land and existing structures required in connection with the proposed work, which have been transferred to the United States without expense.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1909, was $7,761.80, none of which was applied to maintenance.

The expenditures during the fiscal year have been for dredging, pier removal, crib construction, and general supervision in furtherance of the existing project.

About 2 per cent of the approved project has been accomplished. No practical result in the way of increased depth or width has been obtained as yet. The maximum draft that could be carried June 30, 1909, was about 15 feet. The usual mean annual variation of level of water surface is about 1 foot.

A dam across the Manistique River, located about 1 mile from the mouth of the harbor, constitutes the head of navigation.

Commercial statistics for 1908.—Arrivals of vessels, 44; shipments and receipts, 54,685 net tons. The approximate valuation of the exports and imports could not be ascertained.

The commerce affected by the project is in lumber, coal, and general merchandise. Car ferries call at this harbor during the entire year. The volume of commerce which will be benefited is considerable. No change in the nature of the commerce has as yet resulted.

It is believed that the project will have a material effect in controlling freight rates on bulk commodities, such as coal, grain, and ore, both locally and for transshipment.

It is proposed to expend the available balance in the construction of revetment at mouth of Manistique River, as provided by the project, and in dredging. It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, to the completion of the project. The additional work is necessary to make the improvement available.

July 1, 1908, balance unexpended	$46,816.43
June 30, 1909, amount expended during fiscal year, for works of improvement	2,533.28
July 1, 1909, balance unexpended	44,283.15
July 1, 1909, amount covered by uncompleted contracts	42,108.32
Amount (estimated) required for completion of existing project	288,462.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	288,462.00

HARBOR OF REFUGE, MARQUETTE BAY, MICHIGAN.

Marquette Bay, also known at Presque Isle Harbor, is a small bay within the city limits of Marquette, north of Marquette Harbor, and distant 3 miles therefrom.

The bay is about 1½ miles long and extends into the shore about one-half mile. The natural depth over the greater part of this area was from 18 to 20 feet at low water, and dredging by the United States has not been considered necessary.

Before improvement the locality was fully exposed to storms from the east and northeast, and comparatively little shipping was done.

A resolution of Congress, approved March 20, 1896, directed the Secretary of War to make a survey and submit an estimate for a breakwater in this bay. The results of this survey, with estimates amounting to $20,000 for breakwater 500 feet long and $50,000 for construction of one 1,000 feet long, are published in House Document No. 318, Fifty-fourth Congress, first session.

The project adopted by the act of June 3, 1896, is to build a breakwater 1,000 feet in length off Presque Isle Point.

This breakwater was built to its full length in the years 1897–1900.

The act of Congress approved June 13, 1902, provided that a portion of the appropriation for Marquette Harbor "not exceeding seven thousand five hundred dollars may be expended in connecting the Presque Isle breakwater with the shore."

Under this provision the gap between the breakwater and shore was closed, in the fall of 1902, by a timber pier 216 feet long and 100 linear feet of shore revetment constructed.

No additional work is proposed except for maintenance.

The total amount expended on the project up to the close of the fiscal year ending June 30, 1909, not including outstanding liabilities,

was $57,758.16, of which $2,701.82 was expended for maintenance. The expenditures during the year were for contingencies.

The work done has enabled vessels to lie at the ore pier and other docks in the vicinity in ordinary weather and moderate storms, and shipping has increased greatly.

This harbor is largely used for commercial purposes, but not as a harbor of refuge.

Vessels drawing 19 feet can reach the ore pier at mean low water.

The usual variation of water level extends from 0 to +1 foot above low-water datum.

The lake commerce of this port in 1897 amounted to 1,100 arrivals and departures, with 1,095,243 tons of freight. In 1908 the lake commerce amounted to 285 arrivals and departures, with 972,507 short tons of freight, valued at $2,657,981.

The total commerce from 1897 to 1908, inclusive, is estimated at 18,167,595 short tons, valued at $48,098,075.

The total expenditures by the Government for this harbor to date are one-eighth of 1 per cent of the value of the vessel freight received and shipped during the period covered by these expenditures.

The annual expense of government operations at this harbor, consisting of maintenance, interest, and depreciation, is approximately $3,528. This amounts to $0.004 per ton of vessel freight for the year 1908, to one-third of 1 per cent of the value of this freight, and is less than one-fifth of 1 per cent of the saving in the cost of transportation on this freight by water as compared with rail rates. (See Table 4, Appendix I I 10, of this report.)

Effect of project on freight rates: The saving in cost of transportation by water of 1908 freight over the cost by rail, at the estimated figure of $1.94 per ton, as in Table 4 of this report, amounts to $1,886,664. This was made practicable by the government breakwater at this locality. This harbor, as already stated, is not used for purposes of refuge, and it may be questioned whether its freight business could not have been transacted at Marquette, only 3 miles distant, where the Government had already constructed a harbor.

It is proposed to expend the available balance, together with the appropriation recommended, on repairs to the breakwater.

July 1, 1908, balance unexpended	$902.66
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	160.82
July 1, 1909, balance unexpended	741.84
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	2,000.00

HARBOR AT MARQUETTE, MICH.

This harbor, which had a natural depth of 18 feet or more at mean low water, afforded no protection to vessels from easterly or northeasterly storms, and projects were approved in 1867 and 1887 for the construction of a breakwater composed of cribs filled with rock and projecting from the shore into the bay a distance of 3,000 feet. This breakwater was finished in 1894 practically as projected, but since its commencement extensive repairs have been made to the superstructure.

The amount expended up to the commencement of operations upon the new project was $469,732.44.

A project for a concrete superstructure was approved February 27, 1890. Its estimated cost was $232,936.71.

Work on this concrete superstructure was begun in the spring of 1895, and it is now built to a length of 2,920 feet, which is 97 per cent of the entire length. It is 100 feet short of the end of the old breakwater, and all that remains to complete the existing project is to build a pierhead and connect it with the finished work.

The amount expended on the new project up to the close of the fiscal year ending June 30, 1909, not including outstanding liabilities, was $200,111.85, of which $19,769.83 was spent for maintenance.

The expenditure during the year was for incidental expenses and contingencies.

The work done has resulted in the protection of the ore, coal, lumber, and commercial docks from storms, and has shown the efficiency of the concrete breakwater.

A preliminary examination and a survey of Marquette Harbor and vicinity, "with a view to ascertaining whether further harbor of refuge facilities are needed, and if so, at what point," authorized by the river and harbor act approved June 13, 1902, were made by the district officers, who express the opinion that greater refuge facilities are needed in this vicinity; that Marquette Harbor is the best place for such improvement; and that the additional shelter should be secured by extending the present breakwater for a distance of 1,500 feet, at an estimated cost of $303,000.

If provision be made by Congress for this extension, no pierhead will be required at the present end of the breakwater, but before beginning the extension the regular form of concrete superstructure would have to be continued over the gap of 100 feet which now remains. This would cost $6,000, and the money could be taken from the funds now held in reserve for further improvement ($21,391) awaiting the decision of Congress on this matter.

Between the breakwater and the ore docks to the west there is generally from 20 to 30 feet of water, except at the northerly 400 feet of the harbor, where the depth at low-water datum is only 14 to 18 feet. This shallow water makes it difficult for vessels doing business at the ore docks at the north end of the harbor, besides somewhat restricting the area available for harbor of refuge purposes, and at least a portion of this area should be dredged to a clear depth of 21 feet at low-water datum.

For the maintenance of the breakwater the sum of $10,000 should be appropriated biennially.

The usual variation of water level extends from 0 to +1 foot above low-water datum.

The vessel commerce of this port was 780 arrivals and clearances during the fiscal year ending June 30, 1872, with a registered tonnage of 370,000 tons, and 316 arrivals and clearances in 1908, carrying 904,979 short tons, valued at $5,039,917.

The total commerce from 1867 to 1908, inclusive, is estimated at 25,001,977 short tons, valued at $139,494,336.

The total expenditures by the Government for this harbor to date are one-half of 1 per cent of the value of the vessel freight received and shipped during the period covered by those expenditures.

The commerce of the neighboring harbor of Marquette Bay, 3 miles distant, is also benefited by the improvements at Marquette, as vessels working at Marquette Bay have to run to Marquette for protection in time of severe storms.

The combined commerce of the two ports thus benefited consisted of 601 arrivals and clearances in the calendar year 1908, with 1,644,088 net registered tonnage and 2,000,222 tons of freight received and shipped, valued at $7,697,898.

The total commerce of these two ports from the commencement of government improvements in 1867 to 1908, inclusive, is estimated at 43,169,572 short tons, valued at $187,592,411.

The annual expense of government operations at this harbor, consisting of maintenance, interest, and depreciation, is approximately $37,775. This amounts to $0.04 per ton of vessel freight of Marquette for the year 1908, to three-fourths of 1 per cent of the value of this freight, and is nearly 2 per cent of the saving in the cost of transportation on this freight by water as compared with rail rates.

Effect of project on freight rates: Taking the estimated saving in cost of transportation by water over that by rail as $1.94 per ton, the amount of vessel freight in 1908 as 1,027,715 tons (exclusive of the business done at Presque Isle), makes a total saving of about $2,000,000 for the one year. This may be said to have been effected by government improvements, as lake commerce could not otherwise be transacted at that locality.

It is proposed to expend the appropriation recommended and the available balance (except $21,391 held in reserve for further improvement) for maintenance.

July 1, 1908, balance unexpended	$28,306.18
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	561.78
July 1, 1909, balance unexpended	27,744.40
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

Following is the letter of the Chief of Engineers submitting report of recent survey printed in House Document No. 573, Sixty-first Congress, second session:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, January 18, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated May 21 and November 13, 1909 (with map), on preliminary examination and survey, respectively, called for by the river and harbor act approved March 3, 1909, of Marquette Harbor, Michigan.

The improvement under consideration is the extension of the present United States breakwater for a distance of 1,500 feet in order to provide more complete protection for the vessel commerce transacted, and the deepening by dredging of a shallow area in the harbor in order to facilitate the approach to wharves and increase the effective dimensions of the sheltered basin for anchorage and commercial purposes.

The district officer submits estimates of cost of several types of breakwater extension, type 1 costing $416,000; type 2, $462,000; type 3, $641,000; type 4, $771,000; and type 5, $666,000. He recommends the adoption of type 2, and also recommends the dredging to a mean depth of 23 feet and a least depth of 22 feet an area of about 18 acres in the northern portion of the harbor having a present depth of less than 22 feet, the

least depth being 12 feet and the average being 19 feet, this work necessitating the removal of 125,000 cubic yards of material, at an estimated cost of $27,000. The division engineer is of opinion that the extension of the breakwater in a southeasterly direction, as proposed by the district officer, is advisable, but he selects a different type of structure, roughly estimated by him to cost $450,000. He does not recommend the dredging.

In compliance with the law, these reports have been considered by the Board of Engineers for Rivers and Harbors, and the Board recommends the extension of the breakwater in a southeasterly direction, using type 2, and the dredging within the harbor, as proposed by the district officer, at an estimated cost of $489,000.

I concur with the Board of Engineers for Rivers and Harbors that this locality is worthy of improvement by the General Government in the manner proposed.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

MONROE HARBOR, MICHIGAN.

See report herein under heading Black River, Rouge River, and Monroe Harbor, page 531.

MUSKEGON HARBOR, MICHIGAN.

This harbor is the outlet of Muskegon River, one of the largest in Michigan, which before emptying into Lake Michigan expands into Muskegon Lake. The channel between the lakes in 1867, before operations were begun by the United States, was 3,000 feet long and about 12 feet deep, except at the entrance, where the depth was 11 feet and the channel fluctuating. By private enterprise the entrance had been protected by converging slab piers.

The original project was adopted in 1866 and amended in 1869, 1873, 1881, 1884, 1890, and 1892. To June 30, 1902, there had been expended upon this project the sum of $526,293.36, of which $388,218.42 was for construction and $138,074.94 for maintenance, and there had been constructed a north pier and revetment 2,780 feet long and a south pier and revetment 4,402 feet long, protecting a channel varying in width from 308 feet at the entrance to 167 feet inside and having a proposed depth of 15 feet.

The existing project, adopted by the act of June 13, 1902, provides for widening the channel to 300 feet and deepening it to 20 feet from Lake Michigan to Muskegon Lake. This involved the removal of the narrowing portion of the north pier and revetment, the reconstruction of the same on new line, the extension of both revetments to Muskegon Lake, and the outward extension of the two piers by an aggregate amount of 550 feet. The estimated cost was $380,000.

From July 1, 1902, to June 30, 1909, there was expended upon the existing project the sum of $222,640.64, of which $137,660.80 was for construction and $84,979.84 for maintenance.

The operations during the fiscal year were as follows: The construction of 1,200 feet of sheet pile revetment on the north side of the channel, which was begun in the previous fiscal year, was nearly completed in June, 1909, the only item remaining being the spiking of part of the lower guide timbers. The contract dredging commenced May 4, 1908, for the removal of the interior portion of the old north pier and the widening of the channel as far as the new revetment then extended, was completed July 27, 1908. Dredging

under a new contract for widening and deepening the channel to the present end of the north revetment and deepening it beyond to Muskegon Lake was begun June 8 and is now in progress. All the above operations come under the head of new work. Under the head of maintenance, the U. S. dredge *Gillespie* was employed at the harbor from August 1 to September 1, from October 30 to November 11, from January 4 to 9 and January 25–26, and again from May 21 to July 1, 1909, in maintaining and restoring the required depth. The total quantity dredged by the *Gillespie* during the stated times was 167,344 cubic yards. An obstruction found by the *Gillespie* in mid-channel opposite the life-saving station was removed by a dipper dredge under special agreement.

The present project is about 63 per cent completed.

The length of the completed pier and revetment construction at the present time is 4,150 feet on the north side and 4,710 feet on the south side of the channel, and the maximum draft on June 30, 1909, was 20 feet.

Commerce at this port for 1908 comprised 1,131 entrances and clearances, with 115,269 short tons of cargo, valued at $13,522,000, and was mostly local in character. The local freight rates from Muskegon to Chicago by vessel are about 14 per cent lower than the corresponding rates by railroad.

There are 350 linear feet at the outer end of the north pier that are 24 to 27 years old and in need of repairs above water.

The completion of the project will require 550 feet of pier extension, the remainder of the dredging in the channel between the piers so as to afford 300 feet width and 20 feet depth and the extension of the revetments on the north side of the channel 1,100 feet to Muskegon Lake, estimated to cost $124,750.

The funds remaining available, after paying contract liabilities, will be sufficient for repairing the defective portion of the north pier and for dredging for maintenance by the *Gillespie* during the remainder of the season of 1909. For maintenance of the improvement until June 30, 1911, for completion of the sheet pile revetment on the north side of channel to Muskegon Lake, for dredging the full depth and width of interior channel, and for dredging at the entrance by the U. S. dredge *Gillespie*, it is estimated that $70,000 should be appropriated.

During the season of navigation two lines of steamers regularly use this harbor, which is a terminus of three important railroad lines. Their business is a substantial one, and with increased facilities should grow considerably. A general freight and passenger business is done, and in the summer months this is largely augmented by the fruit and the resort traffic. Muskegon Lake itself is a magnificent harbor, 5 miles long and about 1½ miles wide, with depths varying from 30 to 40 feet. When readily accessible, this will be an excellent harbor of refuge.

The Annual Report of the Chief of Engineers for 1901, pages 3131–3134, and House Document No. 104, Fifty-sixth Congress, second session, contain in full a report upon which the approved project is based. A map showing the harbor and the outlines of the above project accompanies the document mentioned.

It is reported that the project has had a marked influence in providing transportation facilities for commodities at reduced rates.

A report upon a preliminary examination of Muskegon Harbor, made in pursuance of the requirements of the act approved March 3, 1909, was submitted by the district officer under date of May 28, 1909, and is printed in House Document No. 210, Sixty-first Congress, second session.

July 1, 1908, balance unexpended		$90,236.65
Amount allotted from appropriation by river and harbor act approved March 3, 1909		22,000.00
		112,236.65
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$43,154.79	
For maintenance of improvement	16,405.86	
		59,560.65
July 1, 1909, balance unexpended		52,676.00
July 1, 1909, outstanding liabilities		4,006.18
July 1, 1909, balance available		48,669.82
July 1, 1909, amount covered by uncompleted contracts		30,685.72
Amount (estimated) required for completion of existing project		124,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		70,000.00

ONTONAGON HARBOR, MICHIGAN.

Following is the report of the Board of Engineers on a recent survey, printed in House Document No. 602, Sixty-first Congress, second session. The Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., January 17, 1910.

Respectfully returned to the Chief of Engineers, U. S. Army.

The district officer presents for consideration two projects of improvement. One, referred to as the larger project, provides for dredging a channel 190 feet in width from deep water in the lake to the inner end of the piers, and for dredging the area in the inner harbor up to the first bridge, the depth to be 17 feet in the lake and 15 feet between the piers and in the inner harbor; estimated cost, $34,760, and $12,000 annually for maintenance. The other, or smaller, project provides for a channel 150 feet wide and 17 feet deep in the lake, 100 feet wide and 15 feet deep between the piers, and two short channels 75 feet wide and 15 feet deep leading from the inner end of the piers to the nearest end of the principal wharves on each side of the harbor; estimated cost, $15,400, and annual cost of maintenance $8,000. To either of these plans should be added $1,000 annually for the maintenance of the piers. For reasons given, the district officer recommends the adoption of the smaller project. The division engineer is of opinion that the harbor is unworthy of improvement by either plan.

Ontonagon Harbor has been under improvement by the United States since 1867, in which year a project was adopted with a view to securing a depth of 12 feet by building parallel piers extending from the mouth of Ontonagon River to the 18-foot contour in Lake Superior and dredging between the piers. This project was completed in 1889, and subsequent expenditures have been applied to maintenance and repairs.

The Ontonagon River brings down in flood large quantities of material, which rapidly fill up the harbor, and during recent years frequent dredging has been necessary to maintain the channel in serviceable condition. The total expenditures for improvement and maintenance to June 30, 1908, amount to $377,296.24.

In view of the large expenditures made on this harbor both for original work and for maintenance, the small amount of commerce that has developed and the unfavorable physical conditions existing, the Board deemed it advisable before submitting its report to give interested persons an opportunity of presenting further data bearing

upon the improvement of this locality. Invitations were accordingly extended to those concerned, and on January 10, 1910, Hon. H. O. Young, M. C., and Mr. James P. Corgan, president of the village of Ontonagon, appeared before the Board in behalf of those interested and presented additional statements and arguments in favor of the improvement.

The opinion seems to prevail that the lack of commercial development can be attributed to insufficient depth in the past to accommodate the class of vessels available for the transportation of lumber and other commodities handled at this harbor, and that if a depth of about 15 feet were made available commerce would at once respond and show a healthy increase.

The additional information now available confirms the Board in the opinion expressed in its indorsement on the report on preliminary examination, that the continuance of work under the existing project for a depth of 12 feet would not result in benefits proportionate to the cost. To abandon the harbor would mean the complete loss of expenditures already made. The question therefore arises as to the advisability of some further expenditures to determine whether a commerce commensurate with the cost of continuing work at this locality will develop. As stated above, those interested believe such a development would occur, and the district officer appears to share in this belief.

While the prospects are, in the opinion of the Board, not particularly bright, it believes it is advisable to give the locality the benefit of the doubt rather than to abandon the harbor entirely, which is the only alternative. It is therefore recommended that the smaller project proposed by the district officer, at an estimated cost of $15,400, be adopted and the improvement maintained at an annual estimated cost of $9,000 for a period of three years after completion, and that the question of further improvement or maintenance be then determined in the light of the commercial development that takes place during the trial period.

The district officer describes existing wharf and terminal facilities, which appear satisfactory for existing and reasonably prospective commerce. Complying with paragraph 13 of the act of March 3, 1909, the Board reports that there are no questions of water power or other subjects so related to the project proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures in the interests of navigation.

For the Board:

WM. T. ROSSELL,
Colonel, Corps of Engineers,
Senior Member of the Board.

Following is an extract from the report of the officer in charge of the survey:

A statement of the commerce of this harbor for a period of the last five years is given in my preliminary report of May 27, 1909, the mean annual amount being 17,840 tons of freight received and shipped, and the value of which is $666,849. The figures for the last few years show some tendency toward a decrease, and this is undoubtedly owing to the condition of the channels, which have been so much obstructed by the abnormal shoaling of recent years that the available funds for maintenance have not been sufficient to keep the harbor open. The commerce of this harbor has been seriously interrupted in this way, and vessel men are afraid of the harbor.

Naturally, if the harbor were to be kept open by either of the foregoing plans or by any other plan, the commerce would revive and increase in amount. The timber alone which is tributary to this harbor would probably contribute an average of 56,000 tons annually to the freight shipped by vessels for the next twenty years.

PETOSKEY HARBOR, MICHIGAN.

Before work at this harbor was begun by the United States its landing pier was exposed to winds coming from between west and northwest, and in high gales it was dangerous to attempt a landing.

A project was adopted in the river and harbor act of August 18, 1894, which provided for constructing a breakwater 600 feet long about 600 feet west of the outer end of the landing pier and another north of it 500 feet long, or as much longer as might be found necessary to cover the landing from all dangerous seas. Work was begun in 1896. Estimated cost was $170,000.

In 1902 the west breakwater had been built for a length of 400 feet and the north breakwater for a length of 200 feet. Investigation having shown that the north breakwater was too near the wharf and that the entrance between the two breakwaters was too narrow, the project was modified under authority conferred by the act of June 13, 1902, so as to provide for the removal of the north breakwater and the extension of the west breakwater, the final cost not to exceed the amount estimated to complete the original project, viz, $170,000.

The amount expended under the original project and as modified in 1902 up to June 30, 1909, has been $125,500, of which $118,239.40 was for new work, and $7,260.60 for maintenance.

There has been no work of improvement in progress during the fiscal year; the sum of $8.34 was expended for contingencies.

The breakwater as now existing has a total length of 1,345 feet, consisting of 445 feet of stonework and 900 feet of cribwork. The amount expended for construction constitutes about 70 per cent of the estimated cost of the project.

The lake commerce which cleared at this port for 1908 was 20 entrances and departures, with 858 short tons of cargo, valued at $212,000, entirely local in character.

The stone portion of the breakwater is in bad condition, and for the purpose of restoring its efficiency an appropriation of $5,000, for maintenance, is recommended for the fiscal year ending June 30, 1911, as well as $15,000 for the addition of 100 feet to the breakwater, which it is believed will answer all local needs.

Definite information as to the effect of the project on freight rates could not be obtained.

July 1, 1908, balance unexpended	$8.34
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	8.34
Amount (estimated) required for completion of existing project	56,900.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance	20,000.00

HARBOR OF REFUGE AT PORTAGE LAKE, MANISTEE COUNTY, MICH.

In 1879, when work was begun by the United States, there was a channel 4 feet deep and 130 feet wide between slab piers built by local enterprise.

The approved project, adopted in 1879 and amended in 1881 and 1890, contemplates the construction of a harbor of refuge, with an entrance from Lake Michigan 356 feet wide and 18 feet deep, protected by piers and revetments. Estimated cost, revised in 1897 and 1899, was $344,300.

The modifications of the original project have in no way changed its scope, so that essentially the project is to-day as when originally adopted. All expenditures made up to the present time have contributed to the completion of the project in its present form.

To June 30, 1909, there had been expended the sum of $376,566.28, of which $254,129.21 was for construction and $122,437.07 for maintenance.

There was no work of improvement carried on at this harbor during the fiscal year. The expenditures were incurred for surveying purposes.

The approved project is completed as far as pier construction is concerned, but the dredging to the proposed width and depth remains as yet incomplete.

The harbor structures are in good condition. The north pier, comprising 114 feet of pile work in wing at inner end, 1,235 feet of pile work along channel, and 851 feet of cribwork, has a total length of 2,200 feet and projects 1,210 feet beyond the shore line. The south pier, comprising 1,399 feet of pile work, including 17 feet of wing at east end, and 901 feet of cribwork, has a total length of 2,300 feet and projects 1,150 feet beyond the shore line.

As shown by soundings made May 11–12, the maximum draft that could be carried from Lake Michigan to Portage Lake on June 30, 1909, was 17 feet.

The vessel commerce at this harbor for 1908 was 480 arrivals and departures with 3,441 short tons of cargo, valued at $147,000, and was entirely local in character.

This harbor is one practically destitute of local or through commerce, and, while it is doubtful whether a harbor of refuge here will ever be of much service, no just conclusion can be drawn until a channel of ample depth and width has been made available. Unless this is done the larger class of vessels can not use the harbor and the large expenditures already made will, to a considerable extent, be useless. The only way to arrive at a satisfactory determination of the question whether or not vessels will turn aside from the usual vessel course in order to take shelter here is to complete the authorized project, and an estimate for this purpose and for maintenance is accordingly presented. The balance at present available is about $2,900, which will pay for a short period of dredging by the *Gillespie* and for contingencies.

The estimate of funds which can profitably be expended in the fiscal year ending June 30, 1911, is as follows:

For works of improvement: For dredging by contract		$15,000.00
For maintenance of improvement:		
For dredging in 1910 and 1911	$6,000	
For repairs and contingencies	5,000	
		11,000.00
Total		26,000.00

The last published map of this locality is found in the Annual Report of the Chief of Engineers for 1884, page 1974.

July 1, 1908, balance unexpended	$3,008.22
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	74.50
July 1, 1909, balance unexpended	2,933.72
Amount (estimated) required for completion of existing project	15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	26,000.00

SAUGATUCK HARBOR AND KALAMAZOO RIVER, MICHIGAN.

The Chief of Engineers submits with his concurrence the following report of the Board of Engineers on a recent survey, which is printed in House Document No. 635, Sixty-first Congress, second session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., January 17, 1901.

Respectfully returned to the Chief of Engineers, U. S. Army.

The item of law under which this inquiry is made calls for a preliminary examination of "Saugatuck Harbor and Kalamazoo River, with a view to securing increased depth to the town of Douglas." The existing project for this waterway now contemplates a channel of about 18 feet in depth outside the piers, 16 feet in depth between the piers, and 12 feet in depth from the inner end of the piers to the town of Saugatuck. It appears that the depth at the entrance is sufficient to meet the needs of commerce, but that the 12-foot depth in the river above the piers is inadequate. The district officer and the division engineer are of opinion that it is not advisable to extend the improvement to Douglas, but that it is advisable to increase the depth below Saugatuck to 16 feet and to maintain this depth for a period of five years, at the end of which time the advisability of continuing the improvement or abandoning the harbor should be determined. The estimated cost of the improvement proposed is $36,000 for original work and $4,000 annually thereafter for maintenance.

As stated in the Board's indorsement on the report of preliminary examination, it is evident that it is not advisable to continue expenditures under the existing project, and therefore the question is presented as to whether the harbor should be abandoned or further expenditures made in the hope that increased depth will result in developing a commerce commensurate with the amount involved in this improvement and in its future maintenance. The further expenditure required to make this test is small in comparison with the cost of the work up to the present time, and as the amount already expended would be practically lost if the harbor were now abandoned it seems to be the part of wisdom to make the experiment, and the Board recommends that this be done even though it entertains some doubt as to the ultimate results.

With reference to the channel between Saugatuck and Douglas, the Board is in accord with the views of the district officer and the division engineer that this section of the waterway is not worthy of improvement. Interested parties were given an opportunity to present statements and arguments to the Board bearing upon the necessity of improving this reach. One communication received was given consideration.

In view of the foregoing, the Board recommends that the project for this waterway be modified so as to provide for a channel 16 feet in depth from the inner end of the piers to the town of Saugatuck, as proposed by the district officer, at an estimated cost of $36,000; that the whole improvement be maintained for a period of five years after the 16-foot channel is obtained, at an estimated cost of $4,000 annually; and that the advisability of continuing or abandoning the harbor be then determined.

In compliance with the provisions of section 13 of the act of March 3, 1909, the Board reports that there are no questions of terminal facilities, waterpower, or other subjects so related to the project proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures made in the interests of navigation.

The following table shows the water-borne traffic of this port for the last ten years:

Calendar year.	No. entrances and clearances.	Steam.	Other vessels.	Tonnage.	Freight received.	Freight shipped.	Total freight carried.	Increase or decrease over previous year.
					Tons.	*Tons.*	*Tons.*	*Tons.*
1899	1,190	825	375	88,256	4,990	8,720	13,710	.....
1900	1,859	1,327	532	120,946	5,811	6,795	12,606	− 1,104
1901	1,177	1,145	32	546,756	23,286	33,473	56,759	+44,153
1902	808	790	18	101,756	8,410	3,433	11,843	−44,916
1903	912	886	26	91,936	7,658	4,933	12,591	+ 748
1904	544	522	22	65,760	5,072	5,486	10,558	− 2,033
1905	420	420	.....	28,494	625	7,800	8,425	− 2,133
1906	988	938	50	154,628	9,000	12,500	21,500	+13,075
1907	284	284	.....	16,546	3,925	1,765	5,690	−15,810
1908	662	662	.....	23,750	1,000	3,885	4,885	− 805

SOUTH HAVEN HARBOR, MICHIGAN.

This harbor is situated at the mouth of Black River. Improvements were begun in 1867, at which time there existed a channel 7 feet deep and 85 feet wide between slab piers. These piers had been built by residents of the vicinity, at a cost of about $18,000. The banks of the river for 500 feet on each side had a rough protection of close piling.

The project of 1866, as modified in 1869, 1872, and 1888, provided for constructing parallel piers and revetments 175 feet apart at the mouth of Black River, with the object of procuring a channel 12 feet deep and extending the navigable channel one-half mile up Black River to the highway bridge by dredging.

The act approved March 3, 1905, adopted a project for pier extension and dredging to a depth of 16 feet, at an estimated cost of $279,370, and $10,000 annually for maintenance. (See H. Doc. No. 119, 58th Cong., 2d sess.) The law provided, however, that none of the $50,000 appropriated for the improvement should be used, except for maintenance of existing channels, until proper dock lines had been established and suitable bulkheads built along these lines by the city of South Haven or by the riparian owners, and the property lying on the channel side of these dock lines had been deeded to the United States free of cost.

By joint resolution of Congress approved June 29, 1906, $10,000 of the appropriation of March 3, 1905, was made immediately available to afford a 16-foot depth in the channel. This sum was expended prior to June 30, 1907.

The act of March 2, 1907, appropriated $40,000 for this harbor, subject to restrictions similar to those imposed by the act of 1905.

Unless the conditions precedent to the expenditure of the appropriations March 3, 1905, and March 2, 1907, are complied with, further operations must be restricted to maintenance of a 12-foot channel under the project of 1888, which, except for maintenance, has been completed. Owing, however, to the possibility of one or more of the riparian owners at the inner ends of the government piers complying with the prescribed conditions, it is proposed to maintain a channel depth of 16 feet between the piers and 18 feet over the outer bar, so that the requirements of the act of March 2, 1907, on the Government's part may be complied with immediately when such riparian owners have met the requirements of the law on their part.

The total expenditure to June 30, 1909, was $350,739.35, of which $187,253.08 was expended for construction and $163,486.27 for maintenance. This expenditure includes the $10,000 made available by joint resolution of Congress of June 29, 1906, but may otherwise be properly assigned to the original project and its modifications, work under the project of March 3, 1905, not yet having been commenced.

The operations during the fiscal year were confined to completing the dredging in the lower channel by the U. S. dredge *Gillespie*, begun May 26, 1908. The work resulted in temporarily providing a depth of 16 to 17 feet between the piers and of 18 to 20 feet outside of the entrance. A contract was entered into March 27, 1909, for placing additional stone in parts of the piers where the filling is deficient, but no work has yet been done.

For reasons stated, no work has yet been done upon the present project. The available depths on April 14–15, 1909, when soundings

were made, were 15.4 feet in front of the entrance and 14.6 feet between the piers and in the interior channel. Dredging for the restoration of the needed width and depth of channel at the entrance and inside will be begun early in July, 1909.

The water-borne commerce at this port is practically all local in character. In 1908 there were 466 entrances and clearances with 18,765 short tons of cargo, with an estimated value of $4,423,000.

The project of 1888, restricting, as it does, the draft of vessels to 12 feet, imposes such limitations upon their size that the improvement has to-day a diminished effect on freight rates. Until a uniform depth of 16 feet has been made available, the use of the harbor will be confined largely to passenger vessels carrying in addition small quantities of perishable freight, such as fruit. Even in its present unsatisfactory condition, vessel freight rates to and from Chicago are 13 per cent less than the corresponding railroad rates.

The money on hand will be sufficient for the maintenance of the improvement, and accordingly no additional appropriation for that purpose will be needed for the year ending June 30, 1911, if only the project depth of 12 feet in the inner harbor is to be maintained. Should the conditions imposed by the river and harbor acts of March 3, 1905, and March 2, 1907, be complied with by local interests, however, the sum of $153,707, in addition to the funds now available, could be profitably expended in the fiscal year ending June 30, 1911, in prosecutions of the 16-foot project provisionally adopted by said acts.

The Annual Report of the Chief of Engineers for 1904, pages 3056–3069, and House Document No. 119, Fifty-eighth Congress, second session, contain in full the report relating to the existing project. A map of the harbor is attached to the House document.

July 1, 1908, balance unexpended	$63,126.89
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	[a] 4,428.77
July 1, 1909, balance unexpended	58,698.12
July 1, 1909, outstanding liabilities	898.04
July 1, 1909, balance available	57,800.08
July 1, 1909, amount covered by uncompleted contracts	3,598.95
Amount (estimated) required for completion of existing project	248,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	[b] 153,707.00

BLACK RIVER, ROUGE RIVER, AND MONROE HARBOR, MICHIGAN.

(*a*) *Mouth of Black River.*—An extensive bar and shoal exists in the St. Clair River adjoining the mouth of the Black. The bar lies close to the American side and formerly obstructed the approach to the Port Huron docks, while the shoal, forming a "middle ground" nearly 50 acres in extent, crowded the main channel in a sharp curve close to the Canadian shore.

[a] Exclusive of $2.83, refundment of overpayment, which has been deducted from expenditures during the fiscal year.

[b] As explained in the text of the report, this estimate is recommended only upon compliance by local interests with the conditions imposed by the acts of March 3, 1905, and March 2, 1907.

The original project submitted in 1871 contemplated the removal of this bar and the middle ground to a depth of 15 feet, at an estimated cost of $67,320. The work was begun in 1872 and completed in 1878 at a cost of $56,500.

The present project contemplates dredging to a uniform depth of 16 feet along the dock front of Port Huron from the 16-foot curve above to the same curve below the mouth of the river, the plane of reference being 579.6 Work was begun in May, 1889, and finished in 1892, when authority was received to deepen the outer border of the shoal adjacent to the main channel to 18 feet, and the work was done. The amount expended on this work was $29,348.58. Operations since this time have been confined to maintenance, $12,008.31 having been expended for this purpose since the adoption of the present project to June 30, 1909. The last dredging was done in 1907, when the 16-foot depth was restored.

The available balance will be applied to dredging such portion of the bar as may prove to be obstructive to navigation.

As a result of the work heretofore done, through navigation for vessels of moderate draft has been greatly facilitated, and entrance into the Black River proper has been rendered possible for this class of vessels. This, it is believed, has resulted in a reduction of freight rates, the extent of which could not be ascertained.

July 1, 1908, balance unexpended	$2,643.11
July 1, 1909, balance unexpended	2,643.11

(*b*) *Rouge River.*—This stream originally had a channel depth of from 10 to 17 feet from its mouth to where the Wabash Railroad bridge crosses it, a distance of about 3 miles.

Under the provisions of the river and harbor act of August 5, 1886, a survey of the river was made and a project, dated August 25, 1888, prepared for securing a channel depth of 16 feet with a width of 240 feet for a distance of 800 feet from the mouth, and thence with a width of 100 feet to the Wabash Railroad bridge, the plane of reference being 575. The estimated cost was $31,690.39. The work of improvement was commenced in 1888 and completed in November, 1892, at a cost of $30,272.79.

By joint resolution approved April 11, 1898, Congress authorized an extension of the improvement, with depth of 13 feet, up to the Maples road, a distance of about 1½ miles above the Wabash Railroad bridge, limiting the expenditure to $5,000. The river was dredged in 1900, the channel being made 50 feet wide.

The project for this river was modified by act of March 2, 1907, so as to provide an increase in depth from 16 feet to 21 feet between the mouth of the river and the first bridge, a distance of about 1,400 feet; estimated cost, $3,575.

During the season of 1907 the channel was deepened, in accordance with the amended project, to 21 feet, from the mouth to the Solvay Company's tunnel just below the Detroit connecting railroad bridge.

In addition to this work, the channel depth of 16 feet was restored to a point 11,550 feet above the mouth.

Between May 3 and June 30, 1909, dredging was done under contract and a narrow channel was dredged from the mouth of the river to the Detroit United Railway dock.

The funds recently appropriated for maintenance have only been sufficient to open up a narrow channel. An estimate to fully restore

the channel depths and widths of the original project is submitted in the report of the district officer. The appropriation recommended, while considered sufficient for existing commerce, will only partially accomplish this result.

The amount expended on the work of the existing project, as amended to the close of the fiscal year ending June 30, 1909, is $72,640.68, of which $22,558.19 has been applied to maintenance.

The maximum draft that can be carried June 30, 1909, from the mouth to the Solvay tunnel is 21 feet, from there to the Wabash Railroad bridge 14 feet, from there to the Detroit, Monroe and Toledo Railroad bridge 13 feet, and 10 feet to Maples road. The river is navigable for vessels of light draft to the town of Dearborn, 15 miles above the mouth.

The amount requested will be devoted to maintenance of the channel.

The receipts and shipments by vessels during the year 1908 amounted to 277,746 tons, of which 118,825 tons were iron ore, 64,677 tons lumber, and 30,080 tons pulp wood. The value of this commerce is about $1,505,271.

As a result of the improvement the area available for manufacturing plants in the vicinity of Detroit has been greatly extended, and these plants have been enabled to receive the raw materials which they use without transfer or transshipment. As a consequence the cost of the raw materials has been greatly reduced.

The channel banks of this river are low and ill defined, and as not only the banks but also the bed are composed of soft material deterioration of the dredged channel is very rapid. While therefore the growing importance of the industries which rely upon the use of this channel renders it desirable that funds for periodical dredging be provided, it also becomes necessary to demand that the owners of the riparian property, whose value is greatly enhanced by the improvement, shall be called upon to construct proper sand-tight docks. Without such provision recent experience shows that the channel is no sooner dredged than it at once begins to fill up from the material sucked into the channel by the propellers of passing vessels. While therefore the extent of the commerce demands additional depth in the lower portion of the channel, future appropriations should be coupled with the condition that no expenditure be made by the United States until the channel banks within the limits of the improvement have been properly docked.

The effect of the improvement has been to reduce freight rates 30 to 50 per cent for firms actually using dockage on the river.

Receipts and shipments, by vessel, Rouge River.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1893	73,732	.....	1901	105,533	782
1894	47,106	.....	1902	56,701	10,000
1895	113,066	1,024	1903	125,272	10,000
1896	120,590	2,905	1904	242,361	6,898
1897	115,987	9,386	1905	284,140	.....
1898	117,486	10,259	1906	229,861	5,000
1899	92,631	763	1907	248,544	5,000
1900	119,712	4,600	1908	267,746	10,000

(c) *Monroe Harbor.*—The harbor of Monroe, Mich., is within the mouth of the Raisin River at the western extremity of Lake Erie. In its natural condition the river flowed into the lake through several ponds and winding creeks. The depth of water at the deepest mouth of the river in its natural condition did not exceed 5 feet.

The original project for the improvement of Monroe Harbor was adopted in 1834. It had for its object to dredge a new and direct channel 100 feet wide and 10 feet deep from the lake across the marsh, a distance of 4,000 feet, to the portion of the river ordinarily used as a harbor, the protection of the entrance into the lake by parallel piers, 726 feet long and 20 feet wide, extending outward to a depth of 10 feet in the lake, and the protection of the sides of the canal by a revetment. The estimated cost of the work, exclusive of dredging machine, was $55,885. The work was practically completed in 1845, a depth of 9 feet being obtained to a point just below the docks at Monroe. Subsequently the city of Monroe further improved the river channel by cutting a canal about 1,300 feet long, 100 feet wide, and with a depth of from 13 to 16 feet, across a bend of the river. Subsequent operations consisted in repairing and extending the piers, repairing the canal revetment, and in dredging, by which a channel 200 feet wide and 13 feet deep, extending to deep water in the lake, was obtained.

In 1905 a double line of piling was driven, connecting the south pier to the shore, to prevent the lake from breaking through into the canal, and some work was done in replacing rotten deck timbers.

During the summer of 1908 general repairs were made to the piers, placing them in fair condition.

The total amount expended on this work up to the close of the fiscal year ending June 30, 1909, is $260,889.64, of which $110,000 was applied under the original project. It is impossible to separate the portion of this total which has been applied to maintenance. During recent years practically all expenditures have been made for that purpose.

The amount requested will be devoted to maintenance.

The channel, beginning at the outer end, consists of the United States canal, 4,000 feet long, with an available depth of about 11 feet. Three thousand feet farther up the river the Monroe City ship canal begins. This has a length of 1,600 feet and a depth of 10 feet. From the upper end of this canal to the city wharves is 2,600 feet, with a depth of 8.5 feet. The stream is navigable from the lake to the docks at Monroe only, a distance of 2 miles.

This harbor can not accommodate the larger class of vessels used upon the lakes, and its commerce is not large, amounting in the year 1908 to 9,150 tons, valued at $75,000. Of this amount 8,000 tons were sand, the major portion of the balance consisting of fish.

The commerce of this stream is too small to have any effect whatever upon freight rates.

CONSOLIDATED.

July 1, 1908, balance unexpended	$9,348.23
Amount allotted from appropriation by river and harbor act approved March 3, 1909	10,000.00
	19,348.23
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	12,530.17

July 1, 1909, balance unexpended	$6,818.00
July 1, 1909, outstanding liabilities	2,642.32
July 1, 1909, balance available	4,175.74
July 1, 1909, amount covered by uncompleted contracts	746.79
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	21,000.00

CLINTON RIVER, MICHIGAN.

This stream empties into Anchor Bay, in the northwesterly part of Lake St. Clair, and before improvement had a channel depth of about 10 feet, except at several shoals, over which but 5 or 6 feet could be carried, and a broad flat at the mouth with a general depth of 3 to 4 feet.

The first appropriation for the improvement of this river was made August 30, 1852, and from that time to 1886 occasional appropriations, amounting in all to $25,500, were made and expended on various dredging projects.

In 1889 a project for the general improvement of the river was adopted, to cover the entire river from the mouth to Mount Clemens, 8 miles upstream. This project called for an 8-foot channel, a pile dike extending across the flat at the mouth to the 10-foot curve in the bay, for revetments as needed above, and for closing the main channel and making a straight cut through Shoemakers bend. The estimated cost was $25,000, revised and amended in 1888 and 1889 to $34,564. The project was completed in 1893 with the expenditure of $34,546.26.

Since the completion of the project there has been $20,125.21 expended for maintenance, making the total expenditure since adoption of present project to June 30, 1909, $54,671.47.

In 1908 an 8-foot depth was dredged between Market and Macomb Street bridges. Periodical dredging is required for maintenance, and the appropriation recommended will be so applied.

As a result of the work done on this river, a channel 8 feet in depth has been secured from the mouth to the city of Mount Clemens, a pile dike has been built along the north side of the outer channel, and revetments have been built where needed in the river above. The present available depth throughout does not exceed 7 feet. The river is navigable for small boats a considerable distance above Mount Clemens. The effect of the improvement on freight rates can not be determined.

There were received and shipped during the year 1908, 27,567 tons of freight, consisting mainly of coal, logs, lumber, and sand. This is valued approximately at $150,000.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1896	30,749	410	1903	28,411	.....
1897	29,077	.....	1904	22,878	257
1898	29,085	.....	1905	41,759	548
1899	35,525	.....	1906	25,616	284
1900	32,410	282	1907	23,273	1,[illegible]
1901	36,925	.....	1908	27,895	176
1902	33,868	.....			

July 1, 1908, balance unexpended	$835.28
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	442.75
July 1, 1909, balance unexpended	392.53
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

DETROIT RIVER, MICHIGAN.

Before improvement the shoalest part of the channel through Detroit River was at Limekiln Crossing, where the normal depth was from 12½ to 15 feet over a bottom of solid rock.

The water surface, usually changing slowly, may rise or fall from a few inches during many days of calm weather to about 4 feet during severe storms and to about 6 feet during short, severe hurricanes, and the monthly mean may change as much as 2 feet in one year, or 4 feet in forty years.

The first project of 1874 provided for a winding channel of at least 20 feet in depth, over 300 feet in width; modified in 1883 so as to somewhat straighten such channel; in 1886 to give 400 feet width; and in 1888 to give 440 feet in width. The general depth above and below the Limekiln was 20 feet or more, but the bed of the river was studded with large bowlders and rocky shoals, which limited the safe navigable depth to scant 15 feet through a distance of about 12 miles. Accordingly the project was modified and extended in 1892 so as to provide for the removal of all obstructive shoals between the city of Detroit and Lake Erie, with a view to obtaining a through channel with a least width of 600 feet and a navigable depth of 20 feet, at a total estimated cost of $1,554,500, as adopted by river and harbor acts of July 13, 1892, and March 3, 1899, and as approved by the War Department at various dates from 1892 up to July 3, 1899. There has been expended on previous projects and modifications thereof $1,554,500.

The present project was adopted by the river and harbor act of June 13, 1902, which provides for a channel 600 feet wide and 21 feet deep from Detroit to Lake Erie. The estimate for the work was increased (see the final report of the survey directed by the act of March 3, 1899, in Annual Report of the Chief of Engineers for 1905, pp. 2292–2296) to $3,750,000, and in accordance with this increase the river and harbor acts of March 3, 1905, and March 2, 1907, authorized the continuation of the improvement to the extent of $700,000 in addition to the $1,750,000 originally authorized. All of this money has been appropriated, but there still remains to be provided for the work $1,300,000. On November 12, 1904, this project was modified to permit of slightly shifting the location of the proposed channel at Bar Point shoals, mouth of Detroit River, without increasing the cost.

The river and harbor act of March 2, 1907, modified the present project so as to provide for two channels—one for downbound, the other for upbound vessels, past Bois Blanc Island. The second channel, called the Livingstone channel (plan B of the report on survey), is to have a least width of 300 feet out to Bar Point, and 800 feet thence to deep water in Lake Erie, with a least depth of 22 feet. Work on this channel is authorized under continuing contracts to the extent of $6,670,950, of which $1,095,950 is yet to be appropriated.

More extended information may be found as follows: Annual Reports of the Chief of Engineers for 1891, pages 2794–2801 (special history); 1896, page 2758 (map), and 1904, pages 3140–3148; also House Document No. 160, Fifty-eighth Congress, second session (main channel to Wyandotte, Mich.), and House Document No. 266, Fifty-ninth Congress, second session (ship channel connecting waters of the Great Lakes).

During the fiscal year work has been prosecuted along Limekiln Crossing range and Hackett range in the Amherstburg channel, and under four separate contracts, each covering one of the four sections of the Livingstone channel. About 70 per cent of the work of improving the Amherstburg channel has been completed and 35 per cent of the Livingstone channel.

There has been expended to June 30, 1909, on the channel now designated as Plan "A," $3,827,683.76, of which amount $2,273,183.76 was applied to the present project, adopted in 1902. The amount expended for Livingstone channel is $2,407,417.01. None of these funds have been applied to maintenance. Upon the completion of the work now under contract and in progress on the channel via Amherstburg, that part of the project will be practically completed, except for the sections along Ballards reef and Bar Point shoals. The work along Ballards reef can not be advantageously done until the completion of the entire Livingstone channel, but as section 4 of the Livingstone channel is now practically completed and open to navigation, work on the Amherstburg channel in this vicinity, the Bar Point section north of Detroit River light-house, will be commenced this season, and $250,000, in addition to available balance, can be profitably expended for this work by June 30, 1911. There has been appropriated $5,575,000 for the Livingstone channel, and $1,000,000 in addition to available balance can be profitably expended to June 30, 1911.

The greatest draft which can be carried over the improved channels June 30, 1909, is 22.04 feet, but this is subject to change considerably, the mean monthly stage for November, 1908, having been 20.04 at this place—Ballards reef.

GENERAL IMPROVEMENT.

July 1, 1908, balance unexpended	$307,482.29
June 30, 1909, amount expended during fiscal year, for works of improvement	130,666.05
July 1, 1909, balance unexpended	176,816.24
July 1, 1909, outstanding liabilities	38,762.00
July 1, 1909, balance available	138,054.24
July 1, 1909, amount covered by uncompleted contracts	3,222.00
Amount (estimated) required for completion of existing project	1,300,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	250,000.00

LIVINGSTONE CHANNEL.

July 1, 1908, balance unexpended	$2,061,181.10
Amount appropriated by sundry civil act approved March 4, 1909	3,000,000.00
	5,061,181.10
June 30, 1909, amount expended during fiscal year, for works of improvement	1,893,598.11
July 1, 1909, balance unexpended	3,167,582.99
July 1, 1909, outstanding liabilities	535,770.00
July 1, 1909, balance available	2,631,812.99
July 1, 1909, amount covered by uncompleted contracts	3,003,168.00
Amount (estimated) required for completion of existing project	1,095,950.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	1,000,000.00

CONSOLIDATED.

July 1, 1908, balance unexpended	$2,368,663.39
Amount appropriated by sundry civil act approved March 4, 1909	3,000,000.00
	5,368,663.39
June 30, 1909, amount expended during fiscal year, for works of improvement	2,024,264.16
July 1, 1909, balance unexpended	3,344,399.23
July 1, 1909, outstanding liabilities	574,532.00
July 1, 1909, balance available	2,769,867.23
July 1, 1909, amount covered by uncompleted contracts	3,006,390.00
Amount (estimated) required for completion of existing project	2,395,950.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	1,250,000.00

ROUGE RIVER, MICHIGAN.

See report herein under heading: "Black River, Rouge River, and Monroe Harbor," p. 531.

SAGINAW RIVER, MICHIGAN.

The Saginaw River has a length of about 22 miles, and is formed by the confluence of the Tittabawassee and Shiawassee rivers. Prior to improvement the entrance to the river was obstructed by a bar in Saginaw Bay, having a minimum depth of about 9 feet. Between the mouth and Bay City the depth varied from 15 to 30 feet. Thence to the head of the river the channel was obstructed by a number of bars, having 7 feet of water.

The original project for the improvement of this river was made in 1866, and contemplated a straight channel 195 feet wide and 12 feet deep across the bar at the mouth. This was completed in 1869. In 1874 the project was extended to include the improvement of the river above Bay City. It included dredging a 10-foot channel across the bars at East Saginaw and Carrollton, and the construction of a pile revetment at the latter place. Later, similar improvements at

Zilwaukee bar, New York Works bar, and Willow Island were added. The cost of the work under this project was $219,000.

In 1882 the existing project was adopted, which provides for a channel 200 feet wide and 14 feet deep from Saginaw Bay to and along the front of Bay City, and thence a channel of same width, 12 feet deep, to the upper limits of the city of Saginaw, the datum plane being 581.1; estimated cost, $546,000. By the river and harbor act of August 5, 1886, the improvement of the west channel along West Bay City was also added to the project.

The work which was done during the succeeding years resulted in securing a channel of the required depth, but of varying widths. On account of the unstable condition of the channel, it was impossible to complete the project as approved, it being necessary to devote periodically a portion of the funds to restoring the depth through bars in the river, which were formed by the spring freshets, thus leaving insufficient funds to complete the improvement. During 1907 a complete survey of the river was made and plans were formulated to complete the project as far as possible with the funds available. Work was begun in May, 1908, under two contracts, and work under the last contract was still in progress at the close of the fiscal year. A channel 14 feet deep and 200 feet wide was secured from the mouth of the river to Portsmouth bridge in Bay City, and 12 feet deep and 200 feet wide from that point to Michigan Central Railroad bridge in Saginaw; thence to Center Street Bridge being made 150 feet wide and 12 feet deep. The portion from the Michigan Central Railroad bridge to the head of the river has not as yet been completed to the project depth and width. A survey of the bar in the bay was made during the month of May, 1909, and it was found that the dredged channel had filled in considerably at the sides and that dredging was necessary to restore the channel called for by the project. It is proposed to do the work by contract at an early date.

The amount expended on the existing project to June 30, 1909, is $703,156.52. In the past no attempt has been made to separate the cost of maintenance from that of original improvement, so that it is impossible now to separate these items.

The available balance and the additional funds requested will be expended for maintenance of the improved channel and the necessary inspection and engineering.

Saginaw River is navigable for a distance of 22 miles from the mouth.

The volume of commerce benefited by the improvement has been decreasing, due to the decrease in the lumber trade in the Saginaw Valley. The value of the commerce carried in 1908 is approximately $3,735,203, and it consisted mainly of lumber, coal, stone, cement, and salt.

The precise effect of the improvement upon freight rates can not be stated. It is undoubted, however, that freight rates, both to Bay City and Saginaw, have been materially lowered by the existence of the improved channel.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1893	651,163	1,069,298	1901	1,250,292	694,741
1894	.....	1,108,307	1902	1,012,620	106,409
1895	391,751	347,146	1903	359,779	17,999
1896	471,106	240,496	1904	264,066	13,010
1897	995,960	354,860	1905	227,226	14,161
1898	1,126,891	364,561	1906	274,245	18,860
1899	728,029	311,547	1907	254,897	20,675
1900	482,253	402,827	1908	243,491	21,157

July 1, 1908, balance unexpended		$101,715.04
Amount allotted from appropriation by river and harbor act approved March 3, 1909		25,000.00
		126,715.04
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$54,079.82	
For maintenance of improvement	27,039.90	
		81,119.72
July 1, 1909, balance unexpended		45,595.32
July 1, 1909, outstanding liabilities		11,340.08
July 1, 1909, balance available		34,255.24
July 1, 1909, amount covered by uncompleted contracts		761.60
Amount (estimated) required for completion of existing project		25,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		25,000.00

WATERWAY ACROSS KEWEENAW POINT, MICHIGAN.

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 325, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., November 11, 1907.

Respectfully returned to the Chief of Engineers, U. S. Army.

The district officer presents a plan and estimate for a harbor of refuge at the eastern entrance of Keweenaw Canal, Michigan, which involves the widening of the present channel to a width of 800 feet for a length of about one-half mile, the construction of a mooring pier 2,000 feet in length along the western edge of the basin thus formed, and the acquisition of certain lands necessary in carrying out the proposed plan. The total cost of the project is $210,000.

This plan will afford facilities for tying up at the pier about twenty vessels of average size and at the same time leave room enough for any vessel to turn around. By the construction of such a harbor the congestion at the other end of the canal will be relieved, and vessels south bound can lie here during stress of weather and start upon their journey as soon as the conditions become favorable, whereas at present they must lie at the other end of the canal, where weather conditions east of Keweenaw Point can not be observed.

In the opinion of the Board the cost of the work is not unreasonable when the extensive navigation interests and the benefits to general lake commerce expected from the proposed improvement are considered. It, therefore, believes it to be desirable for the United States to undertake the work, and recommends the adoption of the general project proposed by the district officer, leaving the details to be determined at the time of construction. The Board recommends, in addition, that no expenditures for the work be made unless the land needed can be acquired at a reasonable cost, either by purchase or condemnation.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

Commerce.—During the navigation season of 1906 the commerce through this waterway amounted to 2,632,355 tons of freight, valued at $102,846,779, and 72,400 passengers. The increase in freight tonnage over that of the preceding year amounted to 9 per cent.

The number of vessels using this waterway in the same year was 3,567, having a net registered tonnage of 2,454,414.

The execution of improvements to this waterway, by enlargement of the channel and protection of the entrances, since the acquirement of title by purchase in 1891, has been followed by a rapid increase in the amount of vessel commerce transacted up to the year 1902. It then fell off temporarily for the next two years, but has been increasing again since then, and was greater in 1906 than in any year previous. As far as can be judged from the past history of this canal and the development of business in the northwest territory which makes use of the Great Lakes waterway, there is likely to be a further increase in the number of vessels and volume of freight through the Keweenaw waterway, and of vessels running there for shelter. The execution of the improvement contemplated would not only give greater accommodation to present commerce, but would probably induce other vessels to make use of this waterway that now pass around the end of Keweenaw Point.

The only mooring piers in this waterway that are free for the use of navigators are at the Lily Pond harbor of refuge, and this is at a distance of 24 miles from the Keweenaw Bay entrance.

MENOMINEE HARBOR AND RIVER, MICHIGAN AND WISCONSIN.

Prior to act of June 13, 1902, the harbor and river constituted two works. By this act they were consolidated.

(*a*) *Harbor.*—Original depth of channel, about 5 feet; width, 200 feet. The original project, adopted in 1871, provided for two parallel piers, 400 feet apart, extending to the 16-foot contour in Green Bay, and for a channel 15 feet deep between them, modified as follows: 1874, extending piers to 17-foot contour; 1890, increasing depth to 17 feet; 1899, increasing depth to 20 feet. Amount expended on original and modified projects, $234,344.77.

(*b*) *River.*—Original navigable depth, 5 feet. The original project, adopted in 1890, provided for a channel 200 feet wide and 17 feet deep, modified as follows: 1892, width at upper end reduced to 100 feet; 1896, formation of a turning basin 250 feet wide, 600 feet long, 17 feet deep at upper end of channel, and extending channel 425 feet for a width of 75 feet. Amount expended on original and modified projects, $114,414.15.

(*c*) *Harbor and river.*—The existing project, adopted by act of Congress approved June 13, 1902, provides for increasing the depth to 20 feet, at an estimated cost of $60,000. Under a provision of the act of March 3, 1905, the existing project was modified by omitting therefrom the improvement of all that portion of the Menominee River above and to the westward of Ogden Street Bridge.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1909, was $55,275.52, of which amount $17,023.83 was applied to maintenance. Of this amount $3,514.17 was derived from miscellaneous sources.

There have been no operations during the fiscal year except taking soundings in the harbor and river. The expenditures during the

fiscal year have been for taking soundings, repairs and purchase of plant, and for general supervision.

The existing project, as modified, was completed in 1903. Since then the expenditures have been for maintenance.

The maximum draft that could be carried June 30, 1909, over the shoalest part of the locality under improvement was about 17½ feet. The mean annual variation of level of water surface is about 1 foot.

The Menominee River is navigable for a distance of about 2 miles from its mouth.

Commercial statistics for 1908.—Arrivals of vessels, 693; shipments and receipts, 269,507 net tons. The approximate value of the exports and imports for port of Marinette, Wis., is $2,358,396; that for the port of Menominee, Mich., could not be obtained. The volume of commerce, while large, is not increasing.

It is believed that the project has a material effect in controlling freight rates on bulk commodities, such as coal, grain, and lumber, both locally and for transshipment.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, in repairs of piers and dredging for restoration of channel.

July 1, 1908, balance unexpended	$5,944.71
Amount allotted from appropriation by river and harbor act approved March 3, 1909	4,000.00
	9,944.71
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	2,044.98
July 1, 1909, balance unexpended	7,899.73
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	20,000.00

HARBOR AT ASHLAND, WIS.

Ashland Harbor is located at the head of Chequamegon Bay, and originally had no protection from the waves which rolled into the bay nor from waves generated within the bay itself by storms.

The natural depth at the entrance, and through the bay up to the vicinity of the present harbor line along a large part of the city front, was at least 19 feet at mean low water, requiring no dredging except for private slips, but for the southwest part of the city front shoaler water is found, which required the dredging of a public channel in front of the harbor line.

The original project, approved December 7, 1888, and modified February 9, 1889, was for the constructing of a pile, slab, and rock breakwater 8,000 feet long, and for dredging a channel in front of the wharves of the city.

The original estimates of cost were, for dredging, $65,540; for breakwater, $165,760.

The act of March 3, 1899, added to this project by authorizing an extension of the breakwater to the shore, thus requiring the ultimate construction of 10,200 feet of breakwater. The emergency river and harbor act of June 6, 1900, provided that the appropriation already made should be expended in building a shore spur 4,700 feet in length

from a point 2,600 feet east of the prolongation of the present breakwater and parallel thereto. This again changed the project, adding greatly to the total length of breakwater to be constructed and largely to the total expense.

The total amount expended on this project and its modifications up to the close of the fiscal year ending June 30, 1909, not including outstanding liabilities, is $456,820.22, of which amount $261,555.06 has been applied to the maintenance of the improvement.

Under this project and its two modifications there have been constructed 7,454 feet of breakwater on the original line and 842 feet on the line fixed by the act of June 6, 1900.

Of the 7,454 feet on the original line 91 feet is detached and uncompleted work near shore, and 7,363 feet is completed breakwater in one piece.

The pile, slab, and rock breakwater on the original line is in very poor condition, and has required large expenditures for maintenance.

The work of revetting this structure with riprap so as to form a permanent rubble-mound breakwater, with the old structure for a hearting, was begun in May, 1903, and has continued with more or less work each year up to the present date, under three successive contracts. Under each of these contracts the plant was small and the rate of progress rather slow, but the low prices obtained under competitive bids compensated in a measure for the greater length of time required. A diagram showing the method of reenforcing the breakwater may be seen in the Annual Report of the Chief of Engineers for 1905, page 1992.

Operations for the fiscal year consisted in the continuation of the work of revetment of the breakwater, on the above-described plan, from July 1, 1908, to November 18, when the existing contract was completed. The results accomplished during this period was the revetment of a linear distance of 1,623 feet of the breakwater, which required the placing of 43,116 tons of rock, at a contract cost of 99 cents per ton, or $42,684.84. This work is for maintenance.

On June 30, 1909, the total distance revetted was 6,905 feet, which is 94 per cent of the entire length of the present breakwater.

The work done gives a protected area of about 1,600 acres and affords safe anchorage and dockage for a distance of 3 miles along the city front.

The usefulness of the breakwater was in evidence when the northeast storm of September 2–3, 1905, caused considerable damage to the village of Washburn, across the bay from Ashland, breaking in 10 of the doors of the large flour shed of the Northwestern Railway Company and cutting away the embankment of the railroad approach, while the numerous docks along the Ashland Harbor front, under the protection of the breakwater, escaped injury. This storm seriously damaged the breakwater itself along the portions which had not been strengthened by the rock embankment.

Dredging by the Government in the years 1897, 1903, and 1907 constructed a channel which has a length of 5,760 feet and extends in front of the existing wharves of the city where the original depth of water was not already sufficient for navigation. This channel now has a width of 80 to 120 feet for a depth of 20 feet or more at mean low water and a somewhat greater width for an 18-foot depth. The width is not as great as it should be.

The dredgings from this channel have been deposited alongside the government breakwater to form an earth embankment and lessen the amount of rock required for the revetment.

Easterly from the dredged channel the natural depth of the bay in front of the harbor line is a little more than 19 feet at mean low water and sufficient for the present needs of commerce.

The usual variation of level of the water surface is from about 0 to +1 foot, referred to mean low water.

The commerce of this port carried by vessels consists principally of iron ore and lumber exported, and coal, mineral oil, and general merchandise imported. (With the commerce of Ashland are included the towns of Washburn and Bayfield, unless otherwise stated.)

The commerce has increased during the twenty-two years the harbor has been under improvement by the United States from 892 arrivals and clearances, with cargo tonnage of 1,400,000 tons (of 2,000 pounds), in 1887, to 1,490 arrivals and clearances, with cargo tonnage of 3,658,530 tons (of 2,000 pounds), valued at $17,738,143, in 1908. The total commerce from 1887 to 1908, inclusive, is estimated at 73,607,250 tons (of 2,000 pounds), valued at $526,624,067, exclusive of logs towed in rafts.

The total expenditures by the Government for this harbor to date are only one-eleventh of 1 per cent of the value of the vessel freight received and shipped during the period covered by these expenditures.

The annual expense of government improvements at this harbor, consisting of maintenance, interest, and depreciation, is approximately $23,605 and amounts to $0.006 per ton of the vessel freight for 1908 (for Ashland alone), to one-tenth of 1 per cent of the value of this freight, and to one-third of 1 per cent of the saving in the cost of transportation on the same freight, by water as compared with rail rates. Further details of these comparisons may be seen in Table 4, Appendix I I 5, of this report.

Effect of project on freight rates: The estimated saving in cost of transportation by water over that by rail is $1.94 per ton, which is more than $6,000,000 for the business of this port in 1908. (See also page 633 of Annual Report of Chief of Engineers for 1908, and Table 3 of Appendix J J 5, Report for 1909.)

The protection to the commerce of Ashland alone afforded by government improvements is fully stated in another part of this report.

The extension of the breakwater for a distance of 637 feet to the west, as required for completion to the projected length of 8,000 feet, has been delayed for some years past in order to strengthen the portion already built. It is now believed that the execution of this extension should be taken up at once. The district officer has submitted an estimate for this extension, in which the details of the original plan are changed so as to substitute for the original piles and slabs a rubble mound, resting on a fill of earth from dredgings deposited without cost to the United States, the rubble mound to be built of rough quarried stone, and of simple construction, and to be terminated at the west end by a pierhead built of timber, rock, and concrete, for a landing and for a suitable finish to the breakwater, and to provide a base for a light-house and fog signal. The cost of this extension is estimated at $50,172. The original estimate, for the pile and slab construction, was $25,811, but at current prices this would be

increased to $64,974, so that the proposed modification in detail is a desirable one on account of both permanency and economy. It has accordingly been adopted by this office.

The amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, will be applied as follows:

For improvement to widen channel to 200 feet	$25,000
For extending breakwater 637 feet (in part)	35,000
Total for improvement	60,000
For maintenance and contingencies (in addition to unexpended balance)	5,000

The additional work proposed is for the purpose of extension of benefits to navigation and commerce.

July 1, 1908, balance unexpended	$64,412.84
Amount allotted from appropriation by river and harbor act approved March 3, 1909	25,000.00
	89,412.84
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	56,733.06
July 1, 1909, balance unexpended	32,679.78
July 1, 1909, amount covered by uncompleted contracts	25,000.00
Amount (estimated) required for completion of existing project	311,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	65,000.00

The river and harbor act of March 3, 1909, authorized a preliminary examination of "Ashland Harbor, with a view to widening the channel to four hundred feet, or to such width as may be deemed suitable for the needs of commerce." Following is the letter of the Chief of Engineers submitting the report thereon:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, January 13, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports by Lieut. Col. G. D. Fitch, Corps of Engineers, dated June 2, 1909, on preliminary examination, and October 15, 1909, with plan and estimate of cost of improvement, called for by the river and harbor act approved March 3, 1909, of Ashland Harbor, Wisconsin, with a view to widening the channel to 400 feet, or to such width as may be deemed suitable for the needs of commerce; also a supplementary report, dated December 3, 1909, regarding terminal and transfer facilities at this locality.

The project for improvement of this harbor by the Government provides for building a breakwater and for dredging a channel in front of the wharves of the city, the dimensions of the channel not being defined by the project. This channel is now about 5,760 feet long and has a width of 80 to 120 feet, with a depth of 20 feet or more at low water and a somewhat greater width for an 18-foot depth.

The district officer submits an estimate in the sum of $46,224 for widening the channel to 200 feet, and a second estimate of cost in the sum of $112,968 for widening the channel to 400 feet. He believes that the proposed widening to 200 feet is desirable and should be executed at once. The further widening to 400 feet he deems inadvisable at present, but believes this work should be authorized, so that it can be undertaken without further change of project whenever the necessities of commerce require it. The division engineer concurs in the former but not in the latter recommendation. In the opinion of the Board of Engineers for Rivers and Harbors the expenditure of $46,224 in widening this channel to 200 feet, and an annual outlay of about $1,000 for maintenance, are justified in the interests of commerce and navigation, and it recommends that the project for the improvement of Ashland Harbor be modified accordingly. The Board does not favor the further widening of the channel as part of the approved project until its necessity shall have become more apparent.

I concur in the recommendation of the Board of Engineers for Rivers and Harbors. Except as considered in the supplementary report, there are no questions of terminal facilities, development of water power, or similar subjects involved in the consideration of this subject.

Very respectfully,

W. L. MARSHALL.
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

GREEN BAY HARBOR, WISCONSIN.

This work consists of two improved channels—first, from the mouth of Fox River northerly to the 21-foot contour in Green Bay; second, Fox River below Depere to the southerly limits of the city of Green Bay. The intervening pool in Fox River, connecting these channels, has a natural depth of from 25 to 40 feet and requires no improvement. The outer channel was originally circuitous and narrow, with an available depth of 11 feet. The original navigable depth of the inner channel was also 11 feet.

The original project for outer channel, adopted in 1866, provided for dredging a channel 200 feet wide, 13 feet deep, and 8,800 feet long, and for revetting about 650 feet of same at Grassy Island, modified as follows: 1872, straightening channel and increasing depth to 14 feet; 1874, depth 15 feet, length 11,600 feet; 1892, depth 17 feet, length 16,500 feet; 1897, increasing width at entrance to 500 feet.

The original project for inner channel, adopted in 1892, provided for dredging a channel 150 feet wide and 13 feet deep, modified as follows: 1896, increasing depth to 17 feet.

These channels were completed by the expenditure of $405,945.18.

The existing project, adopted by Congress by act approved June 13, 1902, provides for increasing the depth of the outer channel to 20 feet, at an estimated cost of $105,600. It also provides for maintenance of existing works.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1909, was $125,275.77, of which amount $22,936.05 was applied to maintenance.

The expenditures during the fiscal year have been for dredging for restoration of both outer and inner channels, for taking soundings, and for general supervision.

The approved project was completed in 1903. Since then all expenditures have been for maintenance.

The maximum draft that could be carried June 30, 1909, was about 19 feet in the outer channel and 11½ feet in the inner channel. The mean annual variation in level of water surface is about 1 foot. Connecting with the upper end of the inner channel at Depere, Wis., Fox River is navigable by canals and slack-water navigation to Portage, Wis., a distance of 156 miles.

Commercial statistics for 1908.—Arrivals of vessels, 1,381; shipments and receipts, 659,077 net tons. The approximate value of exports and imports could not be ascertained.

The commerce of Green Bay is large and of a general character.

It is believed that the project has a material effect in controlling freight rates on bulk commodities, such as coal, grain, and lumber, both locally and for transshipment.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, in maintenance of channels and existing works.

July 1, 1908, balance unexpended	$2,688.32
Amount allotted from appropriation by river and harbor act approved March 3, 1909	12,000.00
	14,688.32
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	4,778.38
July 1, 1909, balance unexpended	9,909.94
July 1, 1909, outstanding liabilities	1,915.00
July 1, 1909, balance available	7,994.94
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	40,000.00

KENOSHA HARBOR, WISCONSIN.

The original depth of water at the mouth of Pike Creek varied from nothing to 4 feet, and the present harbor was not available for purposes of commerce.

The original project, adopted in 1852, provided for a channel 13 feet deep between parallel piers 150 feet apart, modified as follows: 1866, provided for a navigable channel 16 feet deep; 1889, provided for extending north pier 300 feet and south pier 600 feet, and for channel 16 feet deep; 1890, provided for dredging in "The Basin;" 1899, provided for extending the south pier, increasing the width between piers to 250 feet by rebuilding the north pier, building 600 feet of breakwater, and increasing the depth in channel and basin to 21 feet and 20 feet, respectively; 1902, provided for extending the breakwater 100 feet shoreward. The original project as modified was completed in 1900, with the exception of 100 feet extension to breakwater. The total amount expended thereon, including maintenance up to the time of adoption of present project, is $475,815.37.

The existing project, adopted by Congress March 2, 1907, provides for maintenance of 21-foot entrance channel, 20-foot basin, and existing works, and for an extension of 200 feet to the landward end of the breakwater. Estimated cost, $22,000.

The total amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1909, is $23,046.40. Of this amount $14,350.18 was for maintenance.

The expenditures during the fiscal year have been for extension of north breakwater, for dredging, and for general supervision.

The foundation for breakwater extension is completed, and the crib has been built but not yet sunk in place. The channel and the basin have been dredged.

The approved project is completed with the exception of sinking a crib in extension of breakwater and building superstructure thereon.

The maximum draft that could be carried June 30, 1909, was about 19 feet. The usual mean annual variation of level of water surface is about 1 foot.

Connecting with the western terminus of the Government improvement, Pike Creek is navigable for a distance of about 2,500 feet.

Commercial statistics for 1908.—Arrivals of vessels, 359; shipments and receipts, 58,545 net tons. The approximate value of the exports and imports could not be ascertained. The commerce is not large in volume and is chiefly of a local character.

It is believed that the project has a considerable effect in controlling freight rates not only on coal for local consumption brought in by way of the harbor, but also by affording Kenosha the rail rates accorded places at which water competition exists.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, in repairs of piers and breakwater dredging. The work proposed is necessary for maintenance of the harbor.

July 1, 1908, balance unexpended		$33,517.92
Amount allotted from appropriation by river and harbor act approved March 3, 1909		10,000.00
		43,517.92
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$2,613.57	
For maintenance of improvement	13,301.00	
		15,914.57
July 1, 1909, balance unexpended		27,603.35
July 1, 1909, outstanding liabilities		101.53
July 1, 1909, balance available		27,501.82
July 1, 1909, amount covered by uncompleted contracts		22,578.93
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		25,000.00

KEWAUNEE HARBOR, WISCONSIN.

The original entrance to the Kewaunee River was not more than 20 feet wide, with a depth of about 3 feet at its shoalest point, and was obstructed by submerged bowlders. The present harbor was therefore not available for purposes of commerce.

The original project for its improvement adopted in 1881, which is the existing project, provided for an artificial entrance channel 15 feet deep, located about 2,000 feet south of the river mouth, protected by two parallel piers 200 feet apart, and extending from the shore to the 19-foot contour in the lake. Estimated cost, $200,000.

The amount expended up to June 30, 1909, was $176,086.34, of which amount $26,086.35 was for maintenance. Of this amount, $462.86 was derived from miscellaneous sources.

The expenditures during the fiscal year have been for dredging for restoration of channel, repairs of plant, and for general supervision.

The present project was completed in 1898 at a cost of about $150,000; since then all expenditures have been for maintenance.

The maximum draft that could be carried June 30, 1909, was about 15½ feet. The mean annual variation in level of water surface is about 1 foot.

Connecting with the westerly end of the improved channel Kewaunee River has a navigable depth of 4 feet for a distance of about 6½ miles, but there is no regular commerce on the river.

Commercial statistics for 1908.—Arrivals of vessels, 447; shipments and receipts, 83,780 net tons. The commerce is quite large in volume and is of a general character. A line of car-ferry steamers calls at this harbor. The approximate value of the exports and imports could not be ascertained.

The project has a material effect in controlling freight rates, as the car-ferry steamers form a lake-and-rail route between the eastern and western points. It is impracticable to estimate the amount of reduction in rates thereby affected.

It is proposed to expend the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, in repairs to piers and dredging for maintenance of channel.

July 1, 1908, balance unexpended	$4,995.19
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
Miscellaneous receipts	45.42
	10,040.61
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	2,864.09
July 1, 1909, balance unexpended	7,176.52
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	50,000.00

The following report by the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 324, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., October 7, 1907.

Respectfully returned to the Chief of Engineers, U. S. Army.

The district officer submits an estimate of cost, in the sum of $53,690, for deepening to 20 feet the existing channels at Kewaunee Harbor and providing a turning basin of the same depth. He expresses the opinion that this improvement is worthy of being undertaken by the United States, provided that no expenditure be made until the following conditions have been complied with:

First. The city of Kewaunee to donate or cause to be donated to the United States all land that must be acquired for the formation of the turning basin.

Second. The city of Kewaunee to hold the United States free from liability for all damages that may be claimed by riparian owners as a result of the dredging proposed.

Third. The city of Kewaunee to give satisfactory assurance that it will cause to be constructed, as soon as dredging has progressed sufficiently, a suitable revetment, along the line marked "A," across the point between the old and present river channels.

The statistics of commerce contained within indicate that the water-borne freight receipts and shipments during 1906 amounted to 146,590 tons; valued at $9,443,119. The local commerce amounted to 44,428 tons, and the through commerce amounted to 102,162 tons. As the greater part of the through tonnage is handled by car ferries, for which the present harbor facilities are ample, the advisability of undertaking the improvement appears to rest upon whether the outlay necessary will be justified by the probable benefits which it will afford to present local traffic, and by the prospective development of general lake commerce to and from this port, as a result of making it accessible to the class of vessels engaged in such commerce.

While the commerce of the harbor is not large, the cost of the work recommended by the district officer is comparaitvely small, and the Board believes that the probable benefits which the improvement will afford by facilitating the growth of a more general and competitive traffic are sufficient to justify the expenditure. It therefore concurs with the division engineer in recommending the adoption of the project proposed by the district officer under the conditions specified.

MILWAUKEE (INNER) HARBOR, WISCONSIN.

The original condition of the rivers comprised in the inner harbor of Milwaukee is not definitely known. These rivers have been dredged, and a depth of about 21 feet below datum maintained therein, by the city of Milwaukee.

The original project, which is the existing project, was adopted by act of March 3, 1905, and provides for improving Menominee, Milwaukee, and Kinnickinnick rivers, which constitute the inner harbor of Milwaukee. This project provides for the excavation of four turning basins—one in the Menominee and three in the Kinnickinnick; the excavation of a channel 100 feet wide from the turning basin in Menominee River to its mouth and 150 feet wide thence to the harbor entrance; the excavation of a channel 100 to 150 feet wide from the mouth of the Kinnickinnick to the uppermost turning basin in that river, all channels to be 21 feet deep. The estimated cost of this improvement is $318,581. The act in adopting the project provided that no part of the appropriation therefor should be expended unless the Secretary of War shall have satisfactory assurance that the city of Milwaukee will comply with certain conditions. Stated briefly, the city must donate the land for the turning basins, must revert channels and basins wherever necessary, and must maintain the improvement after its completion.

By act approved June 30, 1906, Congress authorized the Secretary of War, in his discretion, to modify this project by omitting the turning basin at the head of navigation in the Kinnickinnick River.

By act approved May 28, 1908, Congress authorized the Secretary of War, in his discretion, to enter into a contract or contracts for the improvement of the Kinnickinnick River, as soon as the city of Milwaukee shall have complied with the foregoing conditions, so far as they apply to the Kinnickinnick River, or any part thereof.

There has been no expenditure under the existing project, no assurance having yet been offered that the city of Milwaukee will fulfill all the conditions above mentioned.

The work is to be done under continuing-contract appropriations, and the balance of the authorization to be appropriated is $218,581.

No portion of the approved project has been accomplished up to June 30, 1909.

The maximum draft which could be carried June 30, 1909, was about 20 feet. The usual mean annual variation of water surface is about 1 foot. The rivers are actually navigable as follows: Milwaukee River, about 2¾ miles; Menominee River, about 2 miles; Kinnickinnick River, about 2¼ miles.

The commerce of Milwaukee has been already described in the report relating to Milwaukee Harbor.

It is believed that the project will have a material effect in controlling freight rates on bulk commodities, such as coal, grain, and ore, both locally and for transshipment. It is impracticable to estimate the amount of reduction in rates thereby effected.

July 1, 1908, balance unexpended	$100,000.00
July 1, 1909, balance unexpended	100,000.00
Amount (estimated) required for completion of existing project	218,581.00

Report on a recent survey is printed in House Document No. 667, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers submitting the same.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, February 8, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated May 12 and October 9, 1909, by Maj. Charles S. Bromwell, Corps of Engineers, on preliminary examination and survey, respectively, with supplemental report of December 11, 1909, relative to terminal facilities, called for by the river and harbor act approved March 3, 1909, of Milwaukee Harbor, Wisconsin, "with a view to the creation of an outer harbor; also with a view to a modification of the present plan of improvement by providing for widening the channels in the inner harbor instead of the construction of certain turning basins heretofore authorized."

The existing project for improvement of Milwaukee Harbor provides for an entrance channel 21 feet deep from Lake Michigan to Milwaukee River; an exterior breakwater on the northerly side of Milwaukee, 8,650 feet long; dredging 4 turning basins, 1 in the Menominee River and 3 in the Kinnickinnick River; and connecting channels 21 feet deep between the turning basins and the harbor entrance. The entrance channel and the breakwater have been completed, but nothing has been done by the United States in the matter of improving the inner harbor, the city not having fully complied with the conditions regarding local cooperation contained in the act adopting the project for this improvement.

The district officer submits a plan for extending the present breakwater and building a new southern breakwater, thus providing an inclosed outer harbor at an estimated cost of $2,170,000. He states, however, that the demands of present and immediately prospective navigation may be met by a modification of the existing project for the inner harbor at an estimated total cost of $345,000, being $26,419 more than the amount authorized for the present project. The modification consists generally of widening and straightening the channels at certain points where congestion of traffic now occurs and includes extension of turning basin No. 1 in Kinnickinnick River so as to include Kinnickinnick Bay, and dredging off certain points on the west side of Jones Island. He recommends the omission of the turning basin near the head of Menominee River and turning basin No. 3 on Kinnickinnick River, provided for in the existing project. While in the opinion of the district officer, an outer harbor will become necessary, he confines his recommendation for the present to the adoption of the modified project for the inner harbor under certain conditions of cooperation by the city of Milwaukee, and in this recommendation the division engineer concurs.

These reports have been referred to the Board of Engineers for Rivers and Harbors for consideration, and the Board agrees with the district officer that certain modifications of the present project are desirable, but states that it is not impressed with the necessity nor advisability of the dredging proposed in Kinnickinnick Bay, except that part included in basin No. 1, already provided for. It therefore recommends, under the conditions specified by the district officer, all other work proposed by him, as follows:

Widening channel along Jones Island	$11,250
Dredging in Menominee River	31,050
Dredging basin No. 1, Kinnickinnick River	44,955
Dredging basin No. 2 and widening Kinnickinnick River	72,090
Contingencies	15,655
	175,000

I concur in the recommendation of the Board.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

MANITOWOC HARBOR, WISCONSIN.

The original depth of water at the mouth of the Manitowoc River was about 4 feet at the shoalest point, and the existing harbor was not available for purposes of commerce.

The original project, adopted in 1854, provided for building parallel piers 220 feet apart and dredging between them to obtain a channel 12 feet in depth connecting Manitowoc River with Lake Michigan, modified as follows: 1881, provided for extending piers to

19½-foot contour and increasing depth to 19 feet at entrance and 15 feet at the shore line; 1890, provided for an exterior breakwater 400 feet long, 24 feet wide; 1896, provided for increasing depth of channel to 20 feet and extending south pier 500 feet; 1902, provided for extending the breakwater 400 feet. The original project as subsequently modified was completed in 1903. The total amount expended thereon, including maintenance up to the time of adoption of present projects, is $454,666.79.

The existing project, adopted by Congress March 2, 1907, provides for maintenance of 20-foot channel and for the reconstruction of the harbor by the removal of outer 500 feet of existing breakwater and nearly all of the old parallel piers and by construction of new breakwaters and piers in accordance with report submitted in House Document No. 62, Fifty-ninth Congress, first session, as modified by Board of Engineers for Rivers and Harbors; estimated cost, $376,000.

The amount expended under the existing project up to the close of the fiscal year ending June 30, 1909, was $397,146.04, of which $162,897.56 was for maintenance.

The expenditures during the fiscal year have been for breakwater and pier construction, for dredging, construction of survey boat, repairs of plant, and for general supervision.

The work has been done under continuing contract appropriations, and the balance of the authorization to be appropriated is $5,500.

The existing project is completed with the exception of the rubble mounds and a moderate amount of dredging. No increase in depth has been obtained, but the present harbor affords greatly increased protection to the entrance to the river, having an excellent stilling effect during storms.

The maximum draft that could be carried June 30, 1909, was about 19½ feet. The usual mean annual variation of level of water surface is about 1 foot.

Connecting with the western end of the government improvement, Manitowoc River is navigable for a distance of about 1.8 miles.

Commercial statistics for 1908.—Arrivals of vessels, 1,593; shipments and receipts, 1,420,524 net tons. The approximate value of the exports and imports could not be ascertained. The commerce is very large in volume and of a general character. Two lines of car-ferry steamers call at this harbor daily throughout the entire year.

The project has a material effect in controlling freight rates, as the car-ferry steamers form lake and rail routes between eastern and western points. It is impracticable to estimate the amount of reduction in rates thereby effected.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, in building concrete superstructure on north breakwater and on concrete caisson breakwaters and in dredging for maintenance of channel. The additional work proposed is necessary for maintenance of the harbor.

July 1, 1908, balance unexpended		$326,136.44
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$231,072.11	
For maintenance of improvement	17,564.44	
		248,636.55
July 1, 1909, balance unexpended		77,499.89
July 1, 1909, outstanding liabilities		8,041.27

July 1, 1909, balance available	$69,458.62
July 1, 1909, amount covered by uncompleted contracts	14,187.00
Amount (estimated) required for completion of existing project	5,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	35,000.00

OCONTO HARBOR, WISCONSIN.

In House Document No. 538, Sixty-first Congress, second session, the Chief of Engineers submits, with his concurrence, the following report of the Board of Engineers on a recent survey:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., December 13, 1909.

Respectfully returned to the Chief of Engineers, U. S. Army.

The district officer presents three plans of improvement for Oconto Harbor, the first two involving the construction of jetties and dredging, at an estimated cost of $446,000 and $180,000, respectively. As there is practically no water-borne commerce at present and the amount of prospective commerce is uncertain, the amount involved in either of these plans appeared to be greater than the Government would be justified in expending, and therefore a third plan was prepared, which provides for dredging only, at an estimated cost of $75,000. It is proposed to dredge a channel 16 feet in depth and 100 feet in width between the present piers, about 300 feet in width just beyond the north pier, and 150 feet in width from the outer end of the south pier to about the 18-foot contour in the lake.

While this plan will be more or less temporary in character, it is believed that it will be sufficient for immediate needs, and that it will demonstrate whether a more permanent improvement will be warranted in the future. Local interests having expressed a desire to cooperate substantially with the General Government in this work, the district officer concludes that the locality is worthy of improvement by the third plan, under certain conditions which he enumerates. The division engineer does not concur in these views.

This is an instance where the principal object sought by those interested appears to be a more equitable adjustment of freight rates, and it is expected this will result if the harbor is sufficiently improved to permit lake vessels of moderate draft to enter and compete with present rail transportation. The benefits to be derived from the improvement are prospective, and the extent to which the harbor would be used is problematical. That local interests believe it will be used and that material benefits will result is indicated by the extent to which these interests appear willing to cooperate in the work. No exact estimate of the cost of the entire work proposed to be done by local interests has been presented, but it appears that the amount involved will approximate the estimated cost of the dredging proposed on the part of the General Government.

While the Board does not believe that a commerce of great magnitude will develop at this harbor, the statement of interested parties that it will be considerable and that beneficial results would follow the improvement seems reasonable. In view, therefore, of the prospective benefits to general commerce, coupled with the substantial contribution proposed by local interests, the Board reports that in its opinion it is advisable for the General Government to undertake the improvement of Oconto Harbor by the plan referred to in the within report as plan C, at an estimated cost of $75,000, under the following conditions, which are substantially those proposed by the district officer:

(*a*) The city of Oconto shall donate or cause to be donated to the United States all necessary land for widening the river and for turning basin, etc.

(*b*) The city and county of Oconto shall raise by taxation or otherwise the sum of $25,000 for the construction of revetments, etc., at and near the mouth of the river, and no part of the government appropriation shall be expended until said sum of $25,000 shall have become available.

(*c*) The city of Oconto shall give assurance satisfactory to the Secretary of War—

(1) That it will build a suitable wharf, a warehouse, and a rail or highway connection between the city and the harbor;

(2) That it will forever maintain the ownership of said wharf, warehouse, etc., so that the use of same may always be open to the public under reasonable regulations as regards wharfage and warehouse fees;

(3) That it will maintain the depth in all channels that shall be dredged by the United States for a period of five years, and in a manner satisfactory to the Secretary of War.

(*d*) All work in connection with the improvement of the harbor by local interests shall be done under the supervision and to the satisfaction of the district engineer.

In compliance with the provisions of section 13 of the act of March 3, 1909, the Board reports that except as indicated within there are no questions of terminal facilities, water power, or other subjects so related to the project proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures made in the interests of navigation.

For the Board:

WM. T. ROSSELL,
Colonel, Corps of Engineers,
Senior Member of the Board.

PORT WASHINGTON HARBOR, WISCONSIN.

The natural channel at the mouth of the Sauk River was narrow, and at the shoalest point had a depth of 1 foot. The present harbor was not available for purposes of commerce.

The original project, adopted in 1869, provided for a channel between parallel piers, 150 feet apart, extending from the shore to the 11-foot contour, and for a basin 600 feet long by 200 feet wide, inside the shore line, modified as follows: June 7, 1877, extending piers to 15-foot contour and a second basin to the northward and nearly at right angles to the first basin, the depth in channel and basins to be 13 feet. The original project, as modified, is the existing project. Estimated cost, $181,527.17.

The amount expended up to June 30, 1909, was $202,901.29, of which $14,337.96 was for maintenance. Of this amount $68.25 was derived from miscellaneous sources.

The expenditures during the fiscal year have been for maintenance of channel and for general supervision.

The existing project was completed in 1895 at a cost of $188,563.33. Since then all expenditures have been for maintenance.

The maximum draft that could be carried June 30, 1909, was about 12 feet. The usual mean annual variation of levels of water surface is about 1 foot.

Commercial statistics for 1908.—Arrivals of vessels, 1,277; shipments and receipts, 32,988 net tons. The approximate value of the exports and imports could not be ascertained. The commerce benefited is small in volume and of a local character. It is believed that the project has a considerable effect in controlling freight rates, not only in coal for local consumption brought in by way of the harbor, but also in affording Port Washington the rail rates accorded places where water competition exists.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, in repairs of piers and dredging. The work proposed is necessary for maintenance of the harbor.

July 1, 1908, balance unexpended	$3,022.10
Amount allotted from appropriation by river and harbor act approved March 3, 1909	4,000.00
	7,022.10
June 30, 1909, amount expended during fiscal year for maintenance of improvement	955.14
July 1, 1909, balance unexpended	6,066.96
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	15,000.00

Report on a recent survey of Port Washington Harbor is printed in House Document No. 306, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, November 10, 1909.

SIR: I have the honor to submit herewith, for transmission to Congress, reports of May 25 and September 14, 1909, by Maj. Chas. S. Bromwell, Corps of Engineers, on preliminary examination and survey, respectively, of Port Washington Harbor, Wisconsin, authorized by the river and harbor act approved March 3, 1909.

Port Washington is on the west shore of Lake Michigan, 25 miles north of Milwaukee and 25 miles south of Sheboygan. Under a project completed in 1895 at a cost of $184,484.39, a small harbor was provided by the excavation of two interior basins having a combined area of 5¾ acres, and a channel between parallel piers 150 feet apart, connecting the basins with Lake Michigan, with a depth of water in the basins and channel of 13 feet.

This depth of water is now insufficient, since the boats able to navigate in such depths are being rapidly superseded by boats of greater draft, and it is becoming extremely difficult to charter boats of such draft as can enter the harbor. There have been attempts to establish a regular boat service to Port Washington, but, owing to the condition of the harbor, masters of vessels were unwilling to enter it in stormy weather, and the service has been intermittent and uncertain and was soon abandoned. Therefore, in the opinion of the district officer, the depths should either be increased to meet the greater draft required or else the improvement of the harbor should be entirely abandoned.

To meet the demands of present lake navigation it would be necessary to provide a depth of 18 feet below datum, but to do this without enlarging the harbor would increase dangerous wave action in the basins and, as it is practically impossible to either lengthen or widen them to any material extent, it will be necessary to provide some kind of exterior protection. The district officer submits a plan for such a comprehensive improvement to a depth of 18 feet by construction of north and south breakwaters, removal of old piers, changing channel of Sauk River, and dredging, at an estimated cost of $312,000, but he does not consider that the commerce of the harbor warrants the expenditure of this amount at this time, though the saving to the port in freight rates is about $72,938 annually. This saving is not due to any economy in transportation effected by the improvement of the harbor, however, but is due to the fact that Port Washington is a lake port and is therefore accorded lower rates by the railways than if it were an inland town. When the condition of the harbor will no longer permit of its use by lake carriers, this port will probably no longer receive the benefits of the lower freight rates, but will be treated as an inland town.

To ascertain whether the improvement of the harbor as proposed should be undertaken, the district officer recommends that further improvement be confined, for the present, to experimental dredging to a depth of 18 feet below datum in channel and basins and repair of piers at a cost of $30,000, and the maintenance of such depth and the present piers for a period of five years at an estimated annual cost of $2,500, contingent, however, upon certain work being done by local authorities. If the results obtained warrant at that time, a study of some further improvement can then be made. The division engineer concurs with the district officer, except as to the dredging within the harbor, which he thinks should be done by local interests.

I concur with the district officer and the Board of Engineers for Rivers and Harbors that the locality is worthy of the experimental work proposed, including maintenance for five years, the question as to further improvement to be then determined, but I do not consider it advisable to impose the conditions requiring work by local authorities recommended by the district officer.

Neither the establishment of terminal and transfer facilities, the development and utilization of water power for industrial and commercial purposes, nor any other subjects not considered in the report are so related to the project as to be coordinated therewith to lessen the cost and to compensate the Government for any expenditure in the interest of navigation.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

About 27,000 tons of coal and 2,000,000 feet of lumber are received at this port by water annually, and the fishing business is quite extensive.

HARBOR AT PORT WING, WIS.

The harbor of Port Wing, formed by the mouth of Flag River, is situated on the south shore of Lake Superior, about 33 miles from the head of the lake.

Before improvement the depth at entrance was small and variable. It was 2 or 3 feet at times, and at other times the entrance was closed entirely.

Previous to government operations the harbor had been improved by private parties to some extent. The entrance had been jettied, but imperfectly and with only partial success, and dredging was necessary every spring for removing a sand bar. Within the harbor much dredging had been done to accommodate the lumber business.

In accordance with the provisions of the act of Congress approved March 3, 1899, a report upon a survey of this harbor with a project for its improvement was submitted on November 20, 1899.

This project provided for the construction of two parallel piers of piling, filled in with slabs and topped with large rock. These piers were to be located 200 feet apart and to be 800 feet and 825 feet long, respectively. A channel 150 feet wide and 15 feet deep was to be dredged between the piers and for 500 feet along the slough. The estimated cost of the improvement was $44,992, increased in 1908 to $56,539, on account of underestimate for dredging in the original estimate.

By act of Congress approved June 13, 1902, the project was adopted; the village of Port Wing conveyed to the United States without cost 7 acres of land at the harbor entrance needed for the improvement, and the work of improvement was commenced in 1903.

The amount expended on this work to the close of the fiscal year ending June 30, 1909, exclusive of outstanding liabilities, was $46,991.66, of which $5,689.71 was for maintenance.

Operations during the year consisted in dredging for the removal of shoals, between the dates of April 22 and May 3, 1909, 7,015 yards at contract cost of $1,245.16. This partially removed the shoals and opened a narrow passage which would accommodate any vessels wishing to do business there. The dredge then proceeded to the work of removing shoals elsewhere, and later will return and complete the dredging of shoals at Port Wing.

The following results have been accomplished: The two entrance piers built, with lengths of 800 and 601 feet, respectively; 45 feet of pile revetment at the inner end of the east pier; dredging which gave an entrance channel 15 feet deep at low water, 100 feet wide, and extending from deep water in the lake through to a distance of 200 feet inside of the inner end of the east pier; a portion of the turning slip, extending 70 feet to the east, past the inner end of the east pier, with a width of 80 feet and a depth of 14 to 16 feet; a pile revetment 100 feet long at the inner end of the west pier, and maintenance of improvement by dredging of shoals and repairs to the piers.

A maximum draft of 14 feet can be carried June 30, 1909, at mean low water over the shoalest portion under improvement. The usual variation of water level extends from mean low water (low-water datum) to 1 foot above datum. The entrance piers have been effective in reducing shoaling very materially.

Private dredging extended a navigable channel to a distance of about 2,500 feet southerly from the entrance, and this improvement

marked the limit of navigation on Flag River. This stretch of river has been redredged from time to time by private enterprise, and the lower portion has an available depth of probably 14 feet for a short distance from the entrance, while the upper portion is now badly shoaled.

The vessel freight of this harbor was 64 arrivals and departures, with 31,127 tons (of 2,000 pounds), valued at $305,000, in 1901, and 288 arrivals and departures, with 23,100 tons (of 2,000 pounds), valued at $312,941, in 1908.

The freight tonnage in 1908 was but 22 per cent of that for the previous year, owing to the general business depression.

The total freight of this port for the six years 1903 to 1908, inclusive, since the date of commencement of government improvements, was 299,294 tons of 2,000 pounds.

The total expenditures by the Government for this harbor to date are only 1⅓ per cent of the value of the vessel freight received and shipped during the period covered by these expenditures.

The annual expense of government improvements at this harbor, consisting of maintenance, interest, and depreciation, is approximately $3,426. This amounts to 1 cent per ton of the vessel freight for 1908, and to 1 1/10 per cent of the value of this freight.

Effect of project on freight rates: This harbor has only water transportation for the movement of its freight, and for this reason no comparison can be made with freight charges by railroad.

The construction of a harbor here has been an essential factor in the development of the commerce of Port Wing. There was no commerce to mention previous to these improvements. In 1907 it amounted to nearly a million dollars.

The principal sawmill of this place, which had shut down in June, 1905, as noted in the Annual Report of the Chief of Engineers for 1905, page 1990, resumed operations in the spring of 1907, with a prospect for continuous work for many years. Other timber products and a good brownstone quarry add materially to the vessel business.

A revised estimate gives $15,237 as the amount required for completing the approved project. Details may be seen in the report of the district officer for 1908.

It is proposed to expend the sum recommended to be appropriated for this harbor for the completion of the project, consisting mainly of dredging to give full dimensions of channels, and for maintenance in removing shoals, and for repairs to the entrance piers. These expenditures will result in an extension of the benefits to navigation.

July 1, 1908, balance unexpended	$0.34
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
July 1, 1909, balance unexpended	5,000.34
July 1, 1909, outstanding liabilities	100.00
July 1, 1909, balance available	4,900.34
July 1, 1909, amount covered by uncompleted contracts	4,400.00
Amount (estimated) required for completion of existing project	15,237.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	20,237.00

RACINE HARBOR, WISCONSIN.

The entrance to this harbor at the mouth of Root River originally varied in depth from absolute closure after storms to about 7 feet, and the present harbor was not available for purposes of commerce.

The original project, adopted in 1842–43, provided for a channel 13 feet deep between parallel piers 160 feet apart, modified as follows: 1866, provided for increasing depth to 16 feet and for extension of piers; 1889, provided for increasing depth to 17 feet and for further extension of piers; 1899, provided for widening channel and increasing depth to 21 feet, for extending the south pier, and for a breakwater 600 feet long; 1902, provided for a change in the location and direction of the breakwater. The original project as modified was completed in 1905. The total amount expended thereon, including maintenance up to the time of adoption of present project, is $507,141.72.

The existing project, adopted by Congress March 2, 1907, provides for maintenance of 21-foot channel and works incident thereto, for extension of north breakwater, for a south breakwater, and for subsequent necessary extensions to each breakwater, in general accordance with type plan as set forth in report submitted in House Document No. 62, Fifty-ninth Congress, first session.

An estimate of the cost of a part of this project, amounting to $225,000, was submitted December 13, 1906, and published in River and Harbor Committee Document No. 3, Fifty-ninth Congress, second session. The Board of Engineers for Rivers and Harbors, in its report on this project published in the same committee document, stated that it was the belief of the Board that the proposed plan "should be held in abeyance until the completion of the proposed improvements at Ludington and Manitowoc, and that the adoption of a new plan for the improvement of any of these other harbors" (including Racine) "should be postponed until the efficiency of the work at these two harbors is demonstrated." At the date of this report the work at neither Ludington nor Manitowoc has been fully completed, and it is believed that at the close of the present season the department will be in better position than at present to submit further recommendation in regard to the work now held in abeyance in consequence of this report of the Board.

Should it be decided, however, not to hold the proposed plan further in abeyance, it is believed that the work of improvement should in the immediate future be confined to extending the north breakwater shoreward, as recommended by the district officer.

The total amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1909, is $50,525.14. Of this amount, $25,492.55 was for maintenance.

The expenditures during the fiscal year have been for extension of north breakwater, for maintenance of channel, for construction of survey boat, and for general supervision.

The breakwater has been extended about 200 feet, the channel dredged, and minor repairs made to breakwater.

It is estimated that not more than 5 per cent of the approved project has been completed up to June 30, 1909. No result in the way of increased depth or width has been obtained, but the extension to the

breakwater has somewhat diminished the disturbances in the harbor during storms.

The maximum draft that could be carried June 30, 1909, was about 19 feet. The usual mean annual variation of level of water surface is about 1 foot. Connecting with the western terminus of the government improvement, Root River is navigable for a distance of about nine-tenths of a mile.

Commercial statistics for 1908.—Arrivals of vessels, 1,344; shipments and receipts, 745,032 net tons. The approximate value of the exports and imports could not be ascertained. The commerce benefited is quite large in volume and of a general character. It is believed that the project has a material effect in controlling freight rates not only on coal and other bulk commodities, both local and for transshipment, but also in affording to Racine the rail rates accorded places at which water competition exists.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, in repairs of piers and breakwater and in dredging. The work proposed is necessary for maintenance of the harbor.

July 8, 1908, balance unexpended		$35,684.04
Amount allotted from appropriation by river and harbor act approved March 3, 1909		5,000.00
Miscellaneous receipts		50.00
		40,734.04
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$18,885.91	
For maintenance of improvement	13,380.52	
		32,266.43
July 1, 1909, balance unexpended		8,467.61
July 1, 1909, outstanding liabilities		351.68
July 1, 1909, balance available		8,115.93
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		80,000.00

SHEBOYGAN HARBOR, WISCONSIN.

The depth of water over the bar at the mouth of the Sheboygan River originally did not exceed 7 feet, and the present harbor was not available for purposes of commerce.

The original project, adopted in 1866, provided for extending the piers built by the city and county of Sheboygan to the 13-foot contour and dredging between them to a depth of 13 feet; modified as follows: 1873, for a deeper channel and pier extension; 1881, for extending piers to 21-foot contour and a depth of 19 feet at entrance, diminishing to 15 feet at shore line; 1894, for increasing width between piers and for a channel 19 feet deep; 1899, for a breakwater 700 feet long; 1902, for extending both piers and increasing depth of channel to 21 feet. The original project as modified was completed in 1904 with the exception of 100 feet of breakwater. The total amount expended thereon, including maintenance, up to the time of adoption of present project, is $575,099.44.

The existing project, adopted by Congress March 2, 1907, provides for maintenance of 21-foot channel and works incident thereto, for extension of north breakwater, for a south breakwater, and for subsequent necessary extensions to each breakwater in general accordance with type plan as set forth in report submitted in House Document No. 62, Fifty-ninth Congress, first session.

An estimate of the cost of a part of this project, amounting to $253,000, was submitted December 13, 1906, and published in River and Harbor Committee Document No. 3, Fifty-ninth Congress, second session. The Board of Engineers for Rivers and Harbors in its report on this project, published in the same committee document, stated that it was the belief of the Board that the proposed plan "should be held in abeyance until the completion of the proposed improvements at Ludington and Manitowoc, and that the adoption of a new plan for the improvement of any of these other harbors" (including Sheboygan) "should be postponed until the efficiency of the work at these two harbors is demonstrated." At the date of this report the work at neither Ludington nor Manitowoc has been fully completed, and it is believed that at the close of the present season the department will be in better position than at present to submit further recommendation in regard to the work now held in abeyance in consequence of this report of the Board.

Should it be decided, however, not to hold the proposed plan further in abeyance, it is believed that the work of improvement should in the immediate future be confined to extending the north breakwater shoreward as recommended by the district officer.

The amount expended under the existing project up to the close of the fiscal year ending June 30, 1909, was $43,334.95, of which $14,444.64 was for maintenance.

The expenditures during the fiscal year have been for extension of breakwater, for dredging for restoration of channel, for construction of survey boat, for repairs of plant, and for general supervision.

It is estimated that not more than 5 per cent of the approved project has been completed up to June 30, 1909. No result in the way of increased depth or width has been obtained, but the extension to the breakwater has somewhat diminished the disturbances in the harbor during storms.

The maximum draft that could be carried June 30, 1909, was about 19 feet. The usual mean annual variation of level of water surface is about 1 foot.

Connecting with the westerly end of the government improvement, Sheboygan River is navigable for a distance of 1½ miles.

Commercial statistics for 1908.—Arrivals of vessels, 661; shipments and receipts, 616,832 net tons. The approximate value of the exports and imports could not be ascertained. The commerce of Sheboygan is quite large and of a general character. It is believed that the project has a material effect in controlling freight rates not only on coal and other bulk commodities, both local and for transshipment, but also in affording to Sheboygan the rail rates accorded places at which water competition exists.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, in repairs of piers and breakwater, and in dredging for maintenance of channel. The proposed work is necessary for maintenance of the harbor.

July 1, 1908, balance unexpended		$36,250.24
Amount allotted from appropriation by river and harbor act approved March 3, 1909		5,000.00
		41,250.24
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$15,519.19	
For maintenance of improvement	12,345.98	
		27,865.17
July 1, 1909, balance unexpended		13,385.07
July 1, 1909, outstanding liabilities		330.72
July 1, 1909, balance available		13,054.35
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		65,000.00

TWO RIVERS HARBOR, WISCONSIN.

The original depth of the entrance to Twin rivers was from 3 to 4 feet and the present harbor was not available for purposes of commerce.

The original project adopted March 3, 1871, provided for the formation of a channel of navigable width and 13 feet deep, connecting Twin rivers with Lake Michigan by building parallel piers extending to the 19-foot contour and dredging between them, at an estimated cost of $265,588.80, modified in 1897, by terminating the piers at the 14-foot contour. The total amount expended on original and modified project was $247,613.35.

The existing project, adopted March 2, 1907, is a modification of plan "A," printed in House Document No. 730, Fifty-ninth Congress, first session, and provides for increasing the depth of channel to 16 feet and for the construction of a stilling basin on the north side of harbor. The sum of $90,000 was appropriated for the purpose.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1909, was $62,957.35, of which $21,379.83 was applied to maintenance.

The expenditures during the fiscal year have been for construction of new pile pier, for dredging in channel and stilling basin, for repairs of such portions of the old piers as form part of the present project, and for general supervision.

The new pile pier has been completed, the channel dredged to a depth of 16 feet, the old piers thoroughly repaired, and about three-fourths of the stilling basin has been dredged. The stilling basin has already an appreciable effect on the harbor during storms. The depth of channel has been increased about 3 feet.

The maximum draft that could be carried June 30, 1909, was about 15 feet. The mean annual variation in level of water surface is about 1 foot. East and West Twin rivers have a navigable depth of 7 feet for a distance of about 3 miles and 7 miles, respectively, from the harbor piers. There is no regular commerce on these rivers. For many years they have been used by rowboats and for floating saw logs.

Commercial statistics for 1908.—Arrivals of vessels, 238; shipments and receipts, 58,315 net tons. Estimated value of exports and imports, $296,087.

The commerce of this harbor is small in volume and of a local character. It is believed that the project has a considerable effect in controlling freight, rates not only on coal for local consumption brought in by way of the harbor, but also affording Two Rivers the rail rates accorded places at which water competition exists.

The amount estimated as a profitable expenditure during the fiscal year ending June 30, 1911, is to be applied in purchasing stone for riprap and pier filling and for dredging for maintenance of channel. The additional work proposed is necessary for maintenance of the harbor.

July 1, 1908, balance unexpended		$75,065.16
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$33,799.01	
For maintenance of improvement	12,736.85	
		46,535.86
July 1, 1909, balance unexpended		28,529.30
July 1, 1909, outstanding liabilities		862.02
July 1, 1909, balance available		27,667.28
July 1, 1909, amount covered by uncompleted contracts		15,728.48
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		5,000.00

FOX RIVER, WISCONSIN.

The Fox and Wisconsin rivers, separated at Portage, Wis., by a distance of only 2 miles, one flowing into Lake Michigan, the other into the Mississippi River, were the early means of communication between those waters. Through a board of public works the State began and carried on the improvement until 1853, when it was transferred to a private company. In 1872 the United States purchased from the Green Bay and Mississippi Canal Company all of its property except the water powers, water-power lots, and personal property.

The present project is that of a Board of Engineers, submitted September 17, 1884, and modified May 14, 1886. It provides for deepening and widening the channel of Fox River from Green Bay to Montello to 6 feet depth and from Montello to Portage to 4 feet depth, with a width of the river channel from Lake Winnebago to Montello of 100 feet, and for the renovation of 12 old locks, at an estimated cost of $602,000.

Appropriations aggregating $593,750 have been provided for this work, and a revision of the estimate indicates that $155,353.36 will be required to complete it.

The improvement of the Wisconsin River was abandoned in 1887.

The amount expended by the United States on the improvement of the Fox and Wisconsin rivers from 1839 (date of first appropriation) to the close of the fiscal year ending June 30, 1909, including about $600,000 expended for flowage damages and $145,000 paid to the Green Bay and Mississippi Canal Company for its property, was $3,810,421.96, of which amount $591,161.39 was expended solely upon the Wisconsin River.

The works on Fox River now consist of 18 stone locks, 2 stone guard locks, and 8 composite locks, 13 canals, 16 permanent and 1

temporary dam, and various accessories, including lock houses, warehouses, a dry dock, levees, waste-weirs, culverts, retaining walls, etc. The harbors of Stockbridge, Calumet, Miller Bay, and Brothertown, Lake Winnebago, have been improved, and snags have been removed and bars dredged in Wolf River, making a 4-foot channel 100 feet wide to New London.

The project depth of 6 feet below mean low water has for the most part been obtained from Depere to Princeton lock, but the revision of the estimate indicates that there is still a large amount of dredging to be done in the levels between Eureka and Princeton lock, where now but 5-foot depths obtain. The dredging of the 6-foot channel between Princeton lock and Montello is now in progress, and the next appropriation will be applied to this section. The district officer recommends that no funds be expended for further work above Montello, as that portion of the river is now regarded as unworthy of improvement.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the improvement was 5 feet from Depere to Berlin lock, 4 feet from there to milepost 64 (about 11 miles above Princeton lock) and 3 feet from milepost 64 to Portage, the head of navigation on the Fox River.

July 1, 1908, balance unexpended	$52,558.37
Amount allotted from appropriation by river and harbor act approved March 3, 1909	20,000.00
Miscellaneous receipts	1.65
	72,560.02
June 30, 1909, amount expended during fiscal year, for works of improvement	23,880.52
July 1, 1909, balance unexpended	48,679.50
July 1, 1909, outstanding liabilities	2,674.42
July 1, 1909, balance available	46,005.08
Amount (estimated) required for completion of existing project	155,353.36
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	50,000.00

HARBOR AT DULUTH, MINN., AND SUPERIOR, WIS.

Previous to the Annual Report of 1897 this harbor was reported on under the separate heads of Duluth, Minn., and Superior, Wis., respectively.

The act of June 3, 1896, unified these harbors under the above title and provided for continuous contracts for its improvement to the amount of $3,130,553.

This harbor consists of the Duluth Canal, the Wisconsin entrance, Superior Bay, Allouez Bay, St. Louis Bay, and St. Louis River to the limits of the cities of Duluth and Superior, about 20 miles from the original natural entry, which before improvement was obstructed by shifting bars with but 9 feet of water over them. The bays were broad expanses of shallow water, averaging only 8 or 9 feet, except along a natural channel through them where the depth was greater, but variable. Depths given in this report are referred to low-water datum, which is a mean low-water level.

The project adopted by the act of March 3, 1881, previous to the present one, was for 16-foot navigation. This was practically completed July 1, 1897, and resulted in giving a good 16-foot navigation through the natural or Wisconsin entry, through the artificial Duluth Canal, over the Duluth Basin of 104 acres, along and parallel to the principal dock lines of Duluth and Superior in Superior and St. Louis bays, and up the St. Louis River to New Duluth, near the head of navigation of the river, with well-defined channels of from 85 to 300 feet in width.

The amount expended on the project of March 3, 1881, and projects prior to operations under existing project was $1,548,183.

The present project, authorized by the act of June 3, 1896, and by the modifications of August 14, 1896, and May 9, 1901, provided for the widening and deepening to a navigable depth of 20 feet of the existing channels, for new channels in Allouez Bay and St. Louis River, for extensive turning and anchorage basins of a navigable depth of 20 feet at the junctions of two or more channels, for widening the Duluth Canal, and for rebuilding the piers at the Duluth Canal and Wisconsin entrance and finishing them off with concrete superstructures built of monolithic blocks.

The estimated cost of the work was $3,130,553, but this referred only to the deepening of the channels and basins by dredging. This has been done at much less than the estimated cost, permitting the purchase of lands to the extent of $106,561.19, the rebuilding of the Duluth Canal piers, at a cost of over $650,000, including price of land, and leaving a balance of about $275,000 toward the rebuilding of the piers at the Wisconsin entrance, under construction from 1903 to 1906.

Further modified by project adopted by act of June 13, 1902, at Superior entry, Wisconsin, with all-concrete construction, increasing the original estimate by $650,000.

The present project has been further modified and enlarged by the act of March 2, 1907, in accordance with the report submitted in House Document No. 82, Fifty-ninth Congress, second session, which provides for excavation of the lake approach to the Duluth entrance to 30 feet for a width of 300 feet, at a cost of $10,000, and the following work at Superior entry: (a) Building a concrete revetment pier on the north side of entrance, similar to one already built in 1904 on the south side under the project before present modification, these two revetments 500 feet apart and terminating near the lake shore of Wisconsin Point; (b) building two converging breakwaters from the shore out to the 30-foot depth, with an opening of 600 feet on line with the axis of the inner entrance, to be of rubble mound construction, terminating in a crib and concrete pier at outer end and a pile pier at inner end; (c) dredging between the breakwaters to form a channel 600 feet wide and 30 feet deep, and further dredging to form a stilling basin; (d) dredging channel between revetments to a depth of 24 feet; (e) protecting the shore line by riprap; and (f) widening the Superior front channel inside the harbor; estimated to cost $1,703,000. The said act also provided for additional dredging near the draw span of the Northern Pacific Railroad bridge, at an estimated cost of $55,500.

The present project has been further modified and enlarged by the act of May 28, 1908, which provides for the expenditure of moneys

heretofore appropriated for the harbor for dredging inside the Duluth entrance, in accordance with a report in House Document No. 221, Sixtieth Congress, first session. This report recommended the enlargement by about 209 acres of the anchorage area of the Duluth Basin, by dredging to a depth of 22 feet, low-water datum, an estimated amount of 4,590,000 yards, at a cost of $550,800. These several modifications have a combined estimated cost of $2,319,300, and, together with the first estimate of $3,130,553, makes a total estimated cost of $5,449,853 for the present project and its modifications.

The amount expended on the existing project to the close of the fiscal year ending June 30, 1909, exclusive of outstanding liabilities, was $4,392,972.83, of which $466,030 was expended for maintenance.

Operations during the fiscal year ending June 30, 1909, include the following:

The extension of the Duluth Harbor Basin, authorized by act of May 28, 1908, was commenced July 8, 1908, and vigorously prosecuted by the contractors until the close of the season, six dipper dredges being employed at one time. The work was resumed on the opening of navigation in 1909, and is now in progress. The results accomplished to June 30, 1909, are the dredging of 1,716,567 yards at a contract cost of $180,239.54, giving a depth of 22 to 24 feet, extending the area of the basin by 66 acres, and giving a total area in the basin to date of about 237 acres. This is new work. The present contract will be completed before the end of this season, with a total contract cost of about $200,000, which is expected to increase the area to a total of about 245 acres.

Enlargement of East Gate Basin.—Private dredging of sand for dock filling was carried on for a number of years at the easterly side of the East Gate Basin (near the Interstate bridge), under permits from the Secretary of War and the supervision of the district officer. About 850,000 yards of sand were thus removed without cost to the United States, and enlarged the turning basin by about 39 acres, but left an uneven bottom, obstructed by shoals. To render this area available for navigation the shoals have been removed by the United States, between the dates of June 25, 1908, and August 11, 1908. The amount dredged was 99,966 yards, at a contract cost of $11,995.92, and gave a depth of 21 to 25 feet. This is new work, and adds much to the safety of navigation in the approach to the bridge.

Removal of shoals.—Dredging for the removal of shoals from several of the channels of this harbor was commenced June 22, 1909, and at the close of the fiscal year amounted to 43,904 yards, and a contract cost of $5,927.04. This work is expected to be completed in July, 1909, at a total cost of about $20,000, and will give a good navigable depth of more than 20 feet. This work was for the purpose of maintenance.

Superior Entry improvement.—During the fiscal year operations were in progress which nearly completed the north concrete revetment; contract work on the construction of the north rubble mound breakwater was prosecuted; a quantity of riprap was removed from the old channel and placed in the south rubble mound breakwater by United States plant; timber cribs for the seaward ends of the two breakwaters were completed, and will be sunk in place later; a trench has been excavated in the lake for the cribs, some of the bearing piles for these cribs have been driven and cut off; a number

of concrete footing blocks have been built to be placed on the cribs; a new steel tug has been completed; and additional plant has been constructed by the United States for use on construction work. The cost of the foregoing operations was $298,447.30, of which $23,467.78 was for administration. The foregoing is new work.

The work done under the existing project up to the close of the past fiscal year has been as follows:

The dredging of channels and basins, which was in operation for six seasons under continuous contract and completed in 1902, removed 21,697,243 yards of material, and gave 17 miles of dredged channels from 120 to 600 feet in width and basins for anchorage and for turning at the junctions of channels and in the vicinity of bridges of an aggregate area of about 360 acres, all of a depth of 20 feet or more at low water. Since then the lake approach to the Duluth Canal has been deepened to 30 feet or more for a width of 330 feet. The lake approach to the Superior entry has been deepened to 30 feet or more for a width of 350 feet. Channels have been widened in St. Louis Bay to adapt them to the reconstructed spans of the Northern Pacific bridge, which have recently been enlarged and altered in position.

The East Gate Basin has been enlarged to the extent of 39 acres, as stated elsewhere, giving increased facilities for the passage of vessels through the Duluth-Superior bridge, and for turning from the Rice Point channel to the Superior front channel.

The Duluth Harbor Basin is being extended in order to provide for much-needed anchorage facilities. The projected amount of such extension, as recommended by the Board, is 209 acres. On June 30, 1909, there had been 66 acres dredged, which is about 31 per cent accomplished of the entire amount. The government harbor line in front of Minnesota Point has been moved inshore to a distance of 750 feet by the Secretary of War in order to provide the room necessary for this extension of the basin.

The maintenance of these channels has been kept up by the removal of shoals, and a maximum draft of 20 feet at mean low water could be carried through any and all of them on June 30, 1909. The usual variation of water level extends from about 0 to + 1 foot above low-water datum. The head of navigation is at the foot of the rapids just above the village of Fond du Lac, on the St. Louis River, about 20 miles from Lake Superior.

All the land necessary for the widening of the Duluth Canal has been acquired by deed of gift, purchase, or condemnation, at a cost of $53,919.05.

The land needed for the improvement at the Wisconsin entrance, the mouth of the Nemadji River, and a marshy island in the St. Louis River, was obtained by condemnation proceedings, at a cost of $42,795.94.

A small parcel of land at the end of Grassy Point and certain lands in Spirit Lake were purchased, at a cost of $3,146.20.

A site for a boat yard on Minnesota Point, near the Duluth Canal, was acquired by purchase and condemnation, at a total cost of $7,200, and the vacation of a portion of a street was effected through the city authorities, which was found necessary in order to carry out a proper system of improvement. This property has now been improved by building a bulkhead and a landing pier, dredging a slip, filling the

yard with sand, moving the four government buildings, which had been occupying leased ground at the foot of Seventh avenue, and by fencing in, paving a roadway, and surfacing and seeding for grass. The cost of this improvement has been about $17,750.

New piers were built for the Duluth Canal. These piers have been equipped with 67 iron lamp-posts, and the city furnishes the electric current for lighting the same during the season of passenger travel by lake.

Concrete walls inclosing the government lands at the Duluth Canal were built and the tracts filled to grade, requiring the deposit of about 50,000 cubic yards of material.

The construction of an engineer building on the government land north of the canal for offices and a watchman's house has been completed, at a cost of about $25,000. On May 1, 1906, the rented office rooms were given up and the new building occupied. It is a substantial building, conveniently near the harbor and United States vessel yard, and well adapted to office purposes. The parking of the canal grounds and the construction of additional concrete walls to protect the grounds from flooding by storms have been completed.

At the Wisconsin Entrance (known also as the Superior Entry) the replacing of the old piers by new ones of concrete construction was begun in 1903. About one-half of the south pier was completed in 1904. A description of the method of construction may be seen in Appendix A A A, page 3779, of the Annual Report of the Chief of Engineers for 1904. During the following two years but little was accomplished in the way of construction at the Superior Entry on account of the destruction of protective works by storms. Work on the concrete piers was ordered discontinued by the Chief of Engineers August 21, 1906, pending the consideration of a report by a board of engineers.

Work on the modified project, in accordance with the act of March 2, 1907, was commenced in the spring of 1907, and has been in progress since that time. The results accomplished are stated in detail elsewhere in this report and in the annual reports for previous years. Up to June 30, 1909, about 44 per cent of this projected improvement has been accomplished.

The lake commerce of this port, Duluth-Superior, during the last season of navigation (1908) amounted to 23,797,162 tons (of 2,000 pounds), valued at $223,114,320, and from the beginning of improvements by the Government in 1867 to 1908, inclusive, the vessel freight entering and departing has amounted to 265,979,134 tons (of 2,000 pounds), valued at $3,103,779,620.

It is believed that the tonnage of Duluth-Superior Harbor is now exceeded by that of but two ports in the United States—New York and Philadelphia.

The vessel freight of Duluth-Superior Harbor for 1908 was 57 per cent of the amount which passed the Sault locks the same year.

For a comparison between the cost of improvements and the volume of commerce, it may be stated here that the total amount of money expended by the Government on the improvement of this harbor from the commencement of work in 1867 up to June 30, 1909, is $5,941,155.83. The vessel freight received and shipped at this port during the same period was 265,979,134 tons, and its market

value was $3,103,779,620. From this it appears that the cost of government improvements has been less than one-fifth of 1 per cent of the value of the freight transported.

The annual expense of government operations in this harbor, consisting of maintenance, interest on the total cost of improvements to date, and depreciation, is approximately $284,852. This annual expense, when compared with the commerce of the harbor, amounts to about 1 cent for each ton of the vessel freight for the year 1908. Compared with the value of the commerce the annual expense amounts to about one-eighth of 1 per cent of the value of the vessel freight for the same year. For a further comparison it appears that the annual expense is only about one-half of 1 per cent of the saving in cost of transportation by water as compared with rail rates on the same freight for the year 1908.

Effect of project on freight rates: It may not be possible to give exact figures showing the effect of the improvements of this harbor on freight rates, but the following statements have a bearing on the question:

The average rate on freight passing through St. Marys Falls canals in 1908 was 0.69 mill per mile per ton, and the average haul was 842 miles, as shown by the official records. If the same freight had been carried by rail, the rate would probably have been as much as 3 mills per ton-mile, making a difference of 2.3 mills per ton-mile.

Assuming this difference to apply to freight for Duluth-Superior Harbor, and that the average haul is 842 miles, the saving in cost of transportation by water would be $1.94 per ton, and for the 23,797,162 tons received and shipped at this harbor in 1908 the saving in cost amounts to about $46,000,000 in that one year.

The saving in cost of this large sum has, of course, been made possible by the government improvements, not only at this harbor, but at St. Marys River and at other points between here and the Lake Erie ports, and it is not known just how much of the above saving should be credited to the Duluth-Superior improvements. It is evident, however, that with any reasonable proportion of such saving in transportation accredited to the improvements at this harbor, which form an essential and necessary part of the whole waterway, the cost of such improvements must be only a small fraction of the saving in freight rates effected thereby.[a]

The foregoing saving to shippers is based upon a comparison of existing rates of transportation by water and rail. In addition to this it should be said that the rail rates are reduced or kept down by the competition of the waterway, and in that way a further saving in transportation is effected. The two modes of transportation having developed contemporaneously during the last half century, it would be hard to say what the railroad rates would be if the Great Lakes

[a] A similar saving in freight rates applies to other harbors in the Duluth district which have railroad connections and where harbor improvements executed by the Government (or in part at private cost) have opened up these harbors to interlake navigation and commerce. The above-named amount of saving in cost of transportation, $1.94 per ton, will be considered as also applying approximately to the harbors of Agate Bay, Ashland, Ontonagon, Marquette, Marquette Bay, Grand Marais, (Mich.), and the local harbors of the Keweenaw waterway, subject to more or less error, according to different local conditions, such as the class of freight, its destination, number of competing railroads, facility of handling freight by boat and by rail, etc.

waterway with its government improvements did not exist but there is hardly room for doubt that they would be materially higher.

The amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, consists of the following items:

(*a*) Dredging to complete anchorage basin at Duluth, Minn., this work being for the extension of benefits		$350,800.00
(*b*) Continuing improvements at the Superior Entry, the work proposed being necessary to make the improvement available, as follows:		
For completion of concrete superstructure to the breakwater heads of north and south rubble mound breakwaters		50,500.00
For completing north and south rubble mound breakwaters		255,530.00
Removal of old timber cribs		19,000.00
Dredging north side of inner channel as shown on sheet 3 (Report of Board of Engineers approved April 5, 1907)		64,368.00
		389,398.00
Administration and contingencies, 20 per cent		77,879.60
		467,277.60
Grand total for improvement		818,077.60
(*c*) For maintenance		25,000.00
Total for improvement and maintenance		843,077.60

With regard to the maintenance of improvements in this harbor it is believed that this could be advantageously provided for by an annual allotment.

With 49 miles of harbor frontage, 17 miles of 20-foot channels, and the handling of over 23,000,000 tons of freight in the past year, there is necessity for the closest inspection, by a special patrol provided with a steam tug, to prevent injurious deposits, encroachments of wharves and other private structures, the enforcement of rules regarding the rafting of logs, the anchorage of vessels, the opening of draws, and the care of United States property. These, with the discovery and removal of shoals, repairs to government piers, the care of parks, and the collection of complete and reliable commercial statistics, which has already proven of great value, it is thought could best be cared for by congressional action authorizing allotments or appropriations to be made on estimates submitted.

For reports of examinations and surveys of Duluth-Superior Harbor, see the Annual Report of the Chief of Engineers for 1906, page 565, where references are given. See also Annual Report for 1907, Appendix J J, page 1833, and Annual Report for 1908, page 648.

July 1, 1908, balance unexpended		$762,735.72
Amount allotted from appropriation by river and harbor act approved March 3, 1909		470,000.00
		1,232,735.72
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$487,488.05	
For maintenance of improvement	40,000.00	
		527,488.05

July 1, 1909, balance unexpended	$705,247.67
July 1, 1909, outstanding liabilities	20,984.36
July 1, 1909, balance available	684,263.31
July 1, 1909, amount covered by uncompleted contracts	170,000.00
Amount (estimated) required for completion of existing project	1,043,799.20
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	843,000.00

The following is extracted from House Document No. 221, Sixtieth Congress, first session:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 5, 1907.

SIR: A northeast storm of unusual severity, occurring late in November, 1905, occasioned the loss or severe injury of two vessels attempting to enter the Duluth entrance to Duluth-Superior Harbor. This entrance has a depth of 26 feet between piers 300 feet apart. In both cases the determining cause of the disaster to the ships appears to have been the touching of the bottom of the lake before reaching the outer ends of the piers.

Considerable damage was done during the same storm to piers and wharves in the Duluth Harbor, and to vessels lying at the same, on account of the severity of wave action transmitted through the canal to the inner basin. Public sentiment demanded an amelioration of these conditions, and by a concurrent resolution passed June 20, 1906, Congress ordered an examination and survey of Duluth Harbor with a view of determining what modifications, if any, should be made in the then existing plan of improvement, apparently having in view the difficulties above outlined. On account of the importance of the matter, a Board was appointed on the recommendation of the Chief of Engineers, which Board submitted a report, published as House Document No. 82, Fifty-ninth Congress, second session. The report of the Board was exhaustive, and was fully reviewed by the Chief of Engineers in presenting it to the Secretary of War for transmisison to Congress.

The conclusions of this report were that none of the remedies suggested by interested parties was practicable. Widening the Duluth Canal is open to serious objections, one of which is that it would increase the severity of wave action in the inner basin, and while ameliorating one difficulty complained of would aggravate another. The Board did find, however, that, in view of the probable cause of the accidents to vessels in the storm of November, 1905, greater safety might be given to the Duluth entrance in heavy weather by increasing the depth in the lake just outside the canal from 26 to 30 feet, so that under no conditions of lake level or wave action would a vessel loaded to pass through the canal be likely to touch bottom outside.

The Board found the only practicable remedy for the danger of entrance through the Duluth Canal in extra heavy weather to lie in a modification of the project then in process of execution at Superior entry, so that in heavy weather vessels may enter at the latter point and reach Duluth Harbor by the inside route.

In the river and harbor act of March 2, 1907, under the head of "Improving harbor at Duluth, Minnesota, and Superior, Wisconsin," Congress authorized the Secretary of War to adopt the recommendations of this Board as to the change in the plan for the Superior entry so as to provide an adequate stilling basin by two breakwaters with an opening of 600 feet between their adjacent ends and a canal through Minnesota Point 500 feet wide, protected by short jetties. This act also stated, "and the Secretary of War may appoint a board to make a reexamination and survey of the Duluth Harbor and entrance thereto with a view to ascertaining the best method for improving the same, either by the extension of the existing piers, the widening of the channel, the construction of one or more breakwaters, and the enlargement of the inner basin in the interests of commerce, and in order to afford a safer entrance to said harbor in times of storm, and better protection to shipping and property within said harbor; also with a view to ascertaining the advisability of constructing a new entrance to the Duluth Harbor basin of a width suitable for the needs of commerce, not exceeding one thousand feet, and the protection of the same by either an outer or inner breakwater, or both, such new entrance to be located southward from the present Duluth entrance and so as to cause the least practicable interference with the waters of the Saint Louis River, together with the probable effect of such entrance upon the property within said harbor."

In compliance with this law and on the recommendation of the Chief of Engineers, another Board of Engineer officers was appointed with personnel entirely different from the former one, and the report of this Board is now submitted for transmission to Congress.

It will be noted that this law, while adopting the remedy proposed by the former Board, orders practically a reconsideration and review of all the propositions which were unfavorably considered by that Board. The present Board has made an exhaustive discussion of the subject, after a personal examination of the locality and a widely advertised and well-attended public hearing, at which, it is believed, every person who had any desire to express himself on the subject did so. The Board found the local sentiment very much divided, so much so as to form no basis of support for conclusions, with the possible exception of the project for an extensive breakwater or breakwaters in front of the Duluth entrance. To this subject the Board gave most careful consideration and, for reasons fully stated in the report, decides adversely to the breakwater project. The Board, however, indicates the best positions for two such breakwaters, in case it is decided to build them, its opinions to the contrary notwithstanding. The report of the Board confirms the views previously held as to the impracticability of widening the Duluth Canal and the futility of extending the piers, and supports the recommendation previously made for a deepening of the lake approach to the canal entrance. The Board finds, however, that an enlargement of the inner basin at the Duluth end of the harbor would be advisable, and recommends dredging to certain proposed lines.

This report has been referred to the Board of Engineers for Rivers and Harbors, and after careful consideration of the subject this Board concurs in the views and recommendations contained therein.

I also concur, and recommend that provision be made by law for the dredging proposed by the Board in the lake approach to the Duluth Canal and in the Duluth inner basin.

Very respectfully,

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

ST. CROIX RIVER, WISCONSIN AND MINNESOTA.

Before improvement the ruling low-water depth on the bars above Lake St. Croix was 2 feet. In Lake St. Croix the channel was in most places 8 to 10 feet deep, but narrow and tortuous.

The project was adopted in 1875, and amended as to estimates of cost in 1882 and 1889. By act of June 3, 1896, the improvement of the harbor and water front of Stillwater was added to the project.

The end sought was to provide a commodious channel 3 feet deep at low water from Taylors Falls to the Mississippi River, a distance of 52.3 miles, and to give adequate harbor facilities at Stillwater. This was to be done by means of dredging in Lake St. Croix and at Stillwater and by dredging and contraction works above Lake St. Croix. The estimate of cost, as finally modified, was $136,700. The project was completed in 1900.

Since that time work of maintenance has been done. The appropriations have not been sufficient to accomplish all that was desired, and the channel above Lake St. Croix has deteriorated so as to be scarcely navigable at low stages. This deterioration is mainly due to the choking of the river by snags and sunken logs.

The amount expended to June 30, 1909, was $147,694.86, of which the amount spent since 1900, $16,285.36, was for maintenance only.

Regular appropriations of $3,600 per annum are needed for the maintenance of this improvement.

The maximum draft that could be carried June 30, 1909, at low water was 3 feet at and below Stillwater. Above Stillwater it was not more than 2 feet. Taylors Falls, about 52 miles from its mouth, is the head of navigation on this stream. The usual variation of level of water surface is about 6 feet.

The commerce of this river is chiefly in logs, which are floated loose to Stillwater, Minn., and rafted below that place. About 84,000,000 feet b. m. of loose logs were floated during the season of 1908, their weight being about 378,000 tons and their value about $1,848,000. About 43,000,000 feet b. m. of logs and manufactured lumber, 4,000,000 laths, and 6,000,000 shingles were rafted below Stillwater, 10 steamboats being engaged in these operations. One steamboat made daily trips during the season between Osceola and Taylors Falls, Minn., carrying passengers and a little freight, but no information could be obtained of the amount of business done. No freight to speak of has been carried on the river in recent years. The work done has had no effect on freight rates.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year 1911 to dredging and the repair of wing dams, such work being necessary to make previous improvements available.

July 1, 1908, balance unexpended	$397.74
Amount allotted from appropriation by river and harbor act approved March 3, 1909	3,600.00
	3,997.74
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	727.60
July 1, 1909, balance unexpended	3,270.14
July 1, 1909, outstanding liabilities	585.29
July 1, 1909, balance available	2,684.85
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	4,000.00

HARBOR AT AGATE BAY, MINNESOTA.

This harbor, situated on the north shore of Lake Superior, 27 miles northeast of Duluth, Minn., is an important shipping port for iron ore and lumber and a harbor of refuge.

Before improvement there was ample depth for navigation, with 18 feet or more at mean low water over the greater portion of the harbor, but the harbor was exposed to storms from the southwest and to reverse swells from severe northeast storms.

The approved project of January 4, 1887, was to construct two breakwater piers on a line toward each other from the eastern and western points of the bay, to be 1,000 and 900 feet long, respectively, leaving an opening of 1,340 feet between their extremities and inclosing an area of 109 acres.

In 1899 the total ultimate length of the easterly breakwater was increased by 50 feet.

The original estimate of cost was $213,000, which was increased to $244,208 (see Annual Report of the Chief of Engineers for 1887) on account of higher prices.

The amount expended on the approved project up to the close of the fiscal year ending June 30, 1909, not including outstanding liabilities, was $250,896.78, of which about $16,839.25 was applied to the maintenance of the improvement.

The amount expended during the year was for incidental expenses and contingencies.

The project was completed on November 1, 1901, and fulfills very effectually the purpose for which it was designed.

The depth at the entrance is over 50 feet, and vessels drawing 20 feet can reach the ore docks in safety.

The usual variation of water level extends from about 0 to about +1 foot above low-water datum.

The commerce of the port has increased from 174 arrivals and clearances of vessels in 1885, with 263,437 tons of freight, valued at $876,613, to 2,034 arrivals and clearances in 1908, with 6,688,602 tons, valued at $16,941,624.

The total value of the commerce of this port from 1887 to 1908, both years inclusive, is $204,511,992.

The total expenditures by the Government for this harbor to date are one-eighth of 1 per cent of the value of the vessel freight received and shipped during the period covered by these expenditures.

The annual expense of government operations at this harbor, consisting of maintenance, interest on cost of improvement, and depreciation, is approximately $14,808. This amounts to $0.002 per ton of the vessel freight for the year 1908 and to 0.87 per cent of the value of this freight, and is one-ninth of 1 per cent of the saving in the cost of transportation on this freight by water as compared with rail rates. Details of these comparisons may be seen in Table 4, Appendix I I 2, of this report.

Effect of project on freight rates: It is estimated that the saving in cost of transportation by water as compared with that by rail for the receipts and shipments of this harbor is approximately $1.94 per ton, which amounts to about $13,000,000 for the year 1908. This is three-fourths of the value of the receipts and shipments for the same year. The government improvements have been an indispensable aid to this commerce. (See the report for harbor at Duluth, Minn., and Superior, Wis.)

The available balance and the appropriation recommended will be expended for repairs and maintenance.

July 1, 1908, balance unexpended	$5,906.62
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	16.71
July 1, 1909, balance unexpended	5,889.91
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	2,000.00

HARBOR AT GRAND MARAIS, MINN.

This harbor is an elliptical bay, whose major axis is about one-half mile and whose minor axis is about one-fourth of a mile in length. It has an opening on the south side, which was originally about 1,000 feet in width. Before improvement there was a maximum depth of 14 feet over a very limited area, the general average depth being only 8 or 9 feet. (Depths are referred to mean low water.) It is the only harbor of refuge on the north shore between Agate Bay and the international boundary line, a distance of 125 miles.

The approved project of April, 1879, is to build two breakwater piers, each 350 feet long, from the east and west points of the bay, or

one pier 700 feet long from the east point, and dredge an anchorage area of about 26 acres to a depth of at least 16 feet, all at an estimated cost of $139,669.40. For reasons explained in the report of the local officer (Annual Report of the Chief of Engineers for 1898, p. 2217), this estimate was increased to $163,954.63.

Two breakwaters, each 350 feet long, have been constructed from the east and west points of the bay, the work being completed on August 13, 1901.

The amount expended on the project up to the close of the fiscal year ending June 30, 1909, not including outstanding liabilities, was $166,316.52, of which about $5,379.84 was for maintenance. The work done has resulted in a more protected harbor and a 16-foot anchorage area of about 26 acres.

The expenditures during the year were for incidental expenses and contingencies.

The minimum mean low-water depth over the shoalest part of the locality under improvement is 15 feet.

The usual variation of water level extends from about 0 to +1 foot above low-water datum.

The commerce of the port has increased from 25 entrances and clearances, made by 4 tugs and 5 schooners, with 60 tons of cargo, valued at $6,000, in 1878, to 1,250 clearances and entrances, all steamers, with 41,125 tons of cargo, valued at $1,253,574, in 1908.

The value of the commerce of the harbor from 1878 to 1908, both inclusive, is estimated at $10,615,608.

The freight tonnage in 1908 was 15 per cent less than in 1907.

The total expenditures by the Government for this harbor to date are 1½ per cent of the value of the vessel freight received and shipped during the period covered by these expenditures.

The annual expense of government operations at this harbor, consisting of maintenance, interest, and depreciation, is approximately $8,232. This amounts to $0.20 per ton of vessel freight for the year 1908, and to 0.66 per cent of the value of this freight.

Effect of project on freight rates: There are no railroads running to this harbor, and the only means of transportation is by water, so that no comparison can be made with railroad charges.

In the original condition of the bay a small commercial business could have been transacted by means of tugs or other vessels of small draft at risk of exposure to storms, and logs could have been rafted to other ports on the lake, also at risk of loss, to be sawed into lumber; but the present commerce of this port could not have been carried on.

The United States improvements have therefore been an indispensable agency in the development of business where none previously existed, and this may be of greater value and importance than a simple reduction of rates.

The available balance and the appropriation recommended will be expended for repairs and maintenance as necessity arises.

July 1, 1908, balance unexpended	$6,079.02
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	45.54
July 1, 1909, balance unexpended	6,033.48
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	2,000.00

The following report of the Board of Engineers on a recent survey, concurred in by the Chief of Engineers, is printed in House Document No. 939, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., February 10, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army. The work proposed by the district officer for the improvement of Grand Marais Harbor, Minnesota, and its cost are as follows:

New east breakwater, 300 feet long	$40,553
Removal of old pier	6,336
Dredging in harbor basin	70,416
Total	117,305

A previous preliminary examination of this locality ordered by the river and harbor act approved June 13, 1902, limited the scope of the improvement proposed to "change in or addition to the east pier." It was apparent at the time of making this examination that such a change would not be justified without additional dredging in the harbor, and for that reason and the further reason that the local commerce did not at the time seem to warrant any large expenditure, the project for changing the east pier was reported unfavorably.

At the present time, however, the conditions are altered, both because the order for the preliminary examination does not limit its scope to pier construction and because the improvement proposed for this harbor has an intimate connection with the project for the establishment of a harbor of refuge on the north coast of Lake Superior, which was reported upon by this Board under date of November 11, 1907.

Recognizing the importance of the establishment of a harbor of refuge for the local commerce of the north coast, the Board is now prepared to recommend such improvement in the harbor at Grand Marais as shall qualify it for this purpose. The Board desires, however, to emphasize its view that the usefulness of such a harbor would probably be limited, at least for the present time, to vessels of moderate draft, since the large lake steamers which enter the port of Duluth would seek shelter from storms in the Apostle Islands rather than at any harbor which might be established on the north coast.

In the report on preliminary examination in 1903, after referring to the difficulty of entering the harbor at certain times on account of the position of the east pier and the existence of a large shoal area within the harbor, the district officer stated "the remedy for this condition of affairs would be the construction of a new east pier" * * * and "dredging away about 9 acres of the shoal area near the entrance," and further on he states "the first and most important remedy would be the dredging previously described, but the act approved June 13, 1902, limits this preliminary examination to any change in or addition to the east pier and therefore eliminates any recommendation in reference to dredging."

In the opinion of the Board, the remedies formerly suggested by the district officer are applicable at the present time, as is also the order of their importance, and the Board believes that the dredging should be tried first and its effect noted before undertaking the construction of a new east pier.

The dredging proposed by the district officer is shown by shaded lines on the accompanying tracing, and for reasons stated within is 8 acres less than that contemplated in the report on preliminary examination. The area to be dredged amounts to 21 acres, which will make available a total of 53 acres of deep water for anchorage and commercial purposes, having a clear depth of 16 feet at low water, which corresponds with the depth of the present basin. The division engineer, however, is of opinion that the dredging should be carried to a depth of 20 feet, and that it should include the entire area within the harbor, amounting to 61 acres.

In the opinion of the Board, the depth proposed by the district officer—16 feet at mean low water—is sufficient to meet the present and reasonably prospective demands of commerce, at least for a number of years to come, and it believes that this depth should be adopted for the present. If in the future the necessity for a greater depth shall become apparent, the question can then be taken up. The dredging proposed by the district officer will practically double the present available area within the harbor, and will afford sufficient room for a very material increase in the use of this harbor, both for commercial purposes and as a harbor of refuge, and until a greater area becomes necessary and the permit for the use of the 8 acres in the western part of the harbor for log-boom purposes is annulled the Board believes the dredging should be confined to the area and depth proposed by the district officer.

To sum up, the Board believes Grand Marais Harbor worthy of further improvement to the extent of the dredging proposed by the district officer, which he estimates will cost $70,416.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

Commerce.—The commerce of this port has increased from 25 entrances and clearances made by 4 tugs and 5 schooners, with 60 tons of cargo, valued at $6,000 in 1878, to 1,224 clearances and entrances, nearly all steamers, with 30,910 tons of cargo, valued at $970,083, in 1906. The character of this commerce is shown in the following detailed statement:

MINNESOTA RIVER, MINNESOTA.

Before improvement the ruling low-water depth at the entrance to Minnesota River was not more than 2 feet. From the mouth to Shakopee, a distance of 23.7 miles, there was a least low-water depth of 7 feet, and from Shakopee to Little Rapids, 11.8 miles, a least depth of 3 feet. From Little Rapids to Mankato, a distance of 78.2 miles, the river was navigable only at the higher stages. Above Mankato navigation was possible only at very high water. Along the entire course the channel was obstructed by bowlders, snags, and overhanging trees.

The project, adopted in 1867, provided for the removal of snags, bowlders, etc., from Yellow Medicine River to the mouth, a distance of 237 miles. The estimate of cost was $117,000. In 1893 the project was modified to include the construction of a low-water dam across the mouth of the river at Pike Island, and the excavation of a new channel through Fort Snelling Chute at the head of Pike Island. When the Minnesota River is low, the Mississippi River, at the head of Pike Island, is ordinarily higher than the Minnesota, and the object of the dam and new channel was to raise the level of the Minnesota at and near Little Rapids during low stages as well as to provide a better entrance. The estimated cost of the new work was $10,000. The project was completed in 1895. Work done since that time has been in maintenance of the channel at the mouth.

By act of June 13, 1902, $2,500 was appropriated for the removal of the dam at Pike Island, should the Secretary of War in his discretion so determine. The dam was removed in 1908.

Amount expended to June 30, 1909, was $139,438.02, of which $7,938.77 was for maintenance of existing improvements.

Appropriations since 1896 have been very small and irregular and have all been applied to the maintenance of the improvement at the mouth of the river, for which purpose they have not been sufficient.

Regular appropriations of $2,000 per annum are needed for the maintenance of this improvement.

The maximum draft that could be carried to Shakopee June 30, 1909, at low water was 5 feet, great improvement in the navigable depth at the entrance having resulted from the removal of the dam at Pike Island.

Little Rapids, 36 miles from the mouth, may be considered the head of navigation at present, although at high stages navigation is possible to Le Sueur, 88 miles from the mouth.

The stream is at present used chiefly by excursion steamers and small pleasure launches. A small freight boat ran between St. Peter and Mankato during the season of 1909, but no statistics could be obtained.

The Minnesota River has as yet had no effect on freight rates, as until this season vessels of commercial size have not been able to enter it.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year 1911 to dredging the river from its mouth to about 2 miles above.

July 1, 1908, balance unexpended		$4,394.93
Amount allotted from appropriation by river and harbor act approved March 3, 1909		2,000.00
		6,394.93
Amount carried to the surplus fund of the Treasury		21.32
		6,373.61
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$2,478.18	
For maintenance of improvement	1,354.77	
		3,832.95
July 1, 1909, balance unexpended		2,540.66
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		2,200.00

RED RIVER OF THE NORTH, MINNESOTA AND NORTH DAKOTA.

Under this project are included the improvements of the Red River of the North, Minnesota and North Dakota, and of Red Lake River, Minnesota.

Before improvements the ruling depth at low water in the Red River of the North from the Canadian frontier to Grand Forks, a distance of 143.5 miles, was 2 feet, and from Grand Forks to Moorhead, 155 miles, 1.5 feet. From Moorhead to Breckenridge, 97 miles, navigation was possible only at the higher stages. The river was obstructed by snags, overhanging trees, etc.

Red Lake River from the head of Red Lake to Thief River Falls, a distance of 135 miles, had a low-water depth of at least 3 feet in most places, but was obstructed by a bar at the mouth of the lake and by bowlders between Thief River Falls and High Landing, a distance of 35 miles, so that the ruling depth was 1.5 feet.

The project for the Red River, adopted in 1878, provided for dredging and removal of obstructions from Breckenridge to the international boundary, and the construction of a lock and dam to overcome the fall at Goose Rapids, the whole being with a view to obtain channels as follows:

Breckenridge to Moorhead, 97 miles, a channel capable of being navigated during high and medium stages of water.

Moorhead to Grand Forks, 155 miles, a channel 50 feet wide and 3 feet deep at low water.

Grand Forks to the northern boundary line, 143.5 miles, a channel 60 feet wide and 4 feet deep at low water.

The estimated cost was $364,598.17. This project was modified as follows: In 1883 the estimated cost was increased to $398,598.17. In

1887 the proposed lock and dam at Goose Rapids was dropped from the project and the estimate reduced to $252,598.37. In 1893 the estimate was increased to $310,320.

The improvement of Red Lake River was added to the project in 1896. It was proposed to provide a depth of 3 feet by dredging and removal of bowlders from Thief River Falls to the head of Red Lake, The amount authorized by Congress to be spent on this work was $9,000. The total estimate for both rivers is therefore at present $319,320.

The total amount expended to June 30,1909, was $339,542.81, of which $37,129.21 was for maintenance. The sum of $159.50 has been returned to the appropriation by the sale of condemned material.

As a result of these expenditures some improvement was made in the few years subsequent to 1878 in the upper section of the river. No work has been done in this section in recent years because there has been no navigation. In the middle section the project was completed, except for 13 miles, in 1894. Since that time the river above Bellmont, N. Dak., has been obstructed by unauthorized bridges, which do not permit navigation. In the lower section the project was completed in 1902.

Since the shoals in this river constantly recur, annual work of maintenance is necessary. The funds supplied not having been sufficient to maintain depths contemplated by the project, the navigable depth of the middle section is now 2 feet and of the lower section 3.5 feet. Nothing beyond work of maintenance has been done in recent years; this has been confined to dredging the worst bars in the vicinity of Grand Forks, N. Dak. The expenditure of at least $7,500 annually would be required to keep the navigated portions of the river in condition.

On Red Lake River work has been confined to the removal of snags, bowlders, and similar obstructions from the channel. No work has been done since 1900, and in 1905 the floating plant used for this work was sold by authority of the Secretary of War.

The actual head of navigation on the Red River of the North is Bellmont, N. Dak., about 180 miles by river from the international boundary. The usual variation of water surface is 25 feet; the maximum variation 49 feet.

Red Lake River is navigable from Thief River Falls to the head of Red Lake, a distance of 135 miles. Below Thief River Falls the river is not navigable. The usual variation of level is about 3.5 feet; the maximum variation about 6 feet.

Red River is regularly used during the summer season by 2 steamboats and 12 barges. During 1908, 12,026 tons of wheat were carried from river points to Grand Forks for transfer to railroads.

Four steamers and 1 launch make use of the Red Lake River, carrying passengers and small amounts of freight. About 60,000,000 feet b. m. of logs were floated down Red Lake River during the season of 1908, their weight being 270,000 tons and their value $1,320,000.

In addition to the above about 400 tons of miscellaneous freight and about 1,000 passengers were carried.

Rates on the Red River steamers are from 70 to 50 per cent less than the railroad rates between common points.

This project has no apparent effect on railroad freight rates.

It is proposed to apply the amount estimated as a profitable expenditure for the fiscal year 1911 in dredging near Grand Forks, N. Dak.

July 1, 1908, balance unexpended	$5,024.80
Amount allotted from appropriation by river and harbor act approved March 3, 1909	7,500.00
	12,524.80
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	5,785.11
July 1, 1909, balance unexpended	6,739.69
July 1, 1909, outstanding liabilities	701.18
July 1, 1909, balance available	6,038.51
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	7,500.00

INDIANA HARBOR, INDIANA.

Indiana Harbor is an artificial channel built by private parties since 1901, the outer portion which makes connection with Lake Michigan being constructed under authority of joint resolution of Congress (Public Resolution—No. 31) approved June 14, 1906. The harbor entrance is located about 6.5 miles southeast of Calumet, or South Chicago, Harbor, Illinois. The inner harbor is a dredged canal which it is proposed to extend inland for a distance of about 3.5 miles to make connection with the Grand Calumet River near the city of Hammond, Ind., with a branch canal 1.5 miles in length connecting with Lake George. Neither the outer harbor nor the inner harbor is as yet fully completed.

The following report of the Board of Engineers is concurred in by the Chief of Engineers and printed in House Document No. 1113, Sixtieth Congress, second session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C. October 12, 1908

Respectfully returned to the Chief of Engineers, U. S. Army.

In its report of September 8, 1908, reviewing that of the district officer on a preliminary examination of this harbor, the Board expressed the opinion that public interests of sufficient extent and importance were now involved at Indian Harbor to warrant the United States in taking over the waterway for the use of the public, and that reasonable expenditures made in accordance with the plan proposed by the district officer would result in benefits commensurate with the amounts so expended.

The general plan of improvement provides for an outer harbor about 300 feet in width and 22 feet in depth and an inner harbor or channel way 200 feet in width and 20 feet in depth, designed ultimately to extend to the Calumet River and to Lake George. It is proposed that the United States shall take over and assume the maintenance of the outer harbor and do such dredging as may be necessary to provide an adequate channel of approach to and between the piers; also to take over the inner channel of waterway and assume its maintenance so fast as private interests shall complete the channel way and equip it with suitable draws; provided, however, the United States shall not take charge of or assume control of any portion of said waterway until the same shall have been deeded free of cost to and accepted by the United States.

The work recommended as essential on the part of the United States when it takes control of this waterway, aside from its future maintenance, is the completion of the dredging of the channel of approach and between the piers. The cost of this work, as estimated by the district officer, will be $62,000. He estimates the cost of main-

tenance at $5,000 per year for the first three years after this work is done. The present location of the channel of approach should be considered as approximate only and subject to such modifications as may be found advisable at the time the United States takes control. It may become necessary at some time in the future to repair, strengthen, or reconstruct the present piers at the entrance and construct a breakwater for the protection of the outer harbor, but these improvements are not deemed essential at the present time.

The Board is of the opinion, concurring with the views of the district officer, that the improvement of Indiana Harbor by the United States is advisable to the extent and in the manner outlined above.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

An actual commerce in the outer harbor has developed, amounting to about 200,000 tons in 1907, and probably 300,000 tons during the year 1908. The probabilities of future development here are very great, it being stated by the district officer that industrial concerns have already invested about $18,000,000, with the prospect of a resulting tonnage of about 5,000,000, valued at $55,000,000, a considerable portion of which can reasonably be expected to be handled by water, particularly the iron ore which will form a large percentage of the incoming tonnage.

The House committee in its report says:

This harbor is located on the south shore of Lake Michigan about 6½ miles from the entrance to Calumet Harbor and River. The harborage consists of two distinctly separate parts, the outer harbor and the inner harbor, both of which are artificial, having been built since 1901 by private parties, as a result of the local demand for a better landing place, and for better accommodations in this part of Lake Michigan at a point as close as possible to Chicago, but on the Indiana side of the boundary line between that State and Illinois.

The outer harbor is formed by the construction of two piers 300 feet apart inclosing a portion of Lake Michigan, and so arranged as to make a reasonably safe entrance, the depth between them to be 22 feet. From the shore line the piers and channel between them extend about 500 feet landward from the lake to the first railroad crossing, which marks the division point between the outer and inner harbor. The inner harbor consists of dredged canals or channel ways 200 feet wide and 20 feet deep, and a suitable turning basin.

The parties interested in the development of this harbor, having indicated a desire to have the United States assume charge of it with a view to its future use by the public, Congress in the river and harbor act of March 2, 1907, directed that an examination be made to determine whether improvement of the harbor by the Government was advisable. This examination was made and the results are set forth in reports printed in House Document No. 1113, Sixtieth Congress, second session. The reports show that there are three municipalities in close vicinity which will be benefited by this improvement of the harbor, namely, East Chicago, Hammond, and Whiting, having an aggregate population of about 50,000 and occupying an area of about 24 square miles.

Within this area are located a very large number of manufacturing and commercial enterprises, embracing the manufacture of steel and iron, chemicals, vehicles, farm and railroad machinery, lumber, etc., all more or less interested in the development of adequate facilities for water transportation. The works and plants at East Chicago, located along Indiana Harbor, alone claim an annual output of 5,000,000 tons, valued at $55,000,000, the estimated cost of the various plants and equipments being $18,000,000, and employment being afforded to over 11,000 men. A considerable portion of this business can reasonably be expected to make use of this harbor, as it can be handled more advantageously and cheaply by water.

For early and rapid development this harbor is thought to have considerable advantage over both Chicago River and Calumet River by reason of the adjoining large areas of ground available for factory purposes at reasonable rates, and because of large areas of inland ponds and rivers easily connected to the inner harbor and of easy future development.

It was recommended in the aforesaid examination reports that the United States take over and assume the maintenance of the outer harbor, and do such dredging as may be necessary to provide an adequate channel of approach to and between the piers, also the inner channel of waterway, and assume its maintenance so fast as the private interests owning and conducting the work shall complete the channel way and equip the bridges crossing it with suitable draws, provided title to the whole waterway is transferred to the United States free of cost. The actual work provided for in this bill is to complete the dredging of the channel of approach in the outer harbor, widen and deepen the same where necessary, and extend the channel to deep water in the lake, all at a cost of $62,000. Eventually it is probable that an adequate breakwater must be constructed.

It is stated that all the conditions precedent to the assumption of control by the United States, as set forth in the said reports, have now been mɜt substantially, except that pertaining to the transfer of title. In order that there may be no chance for mistake or error on this point, the provision incorporated in the bill makes the expenditure of the appropriation and the execution of the work by the United States dependent upon the War Department being satisfied that these conditions have actually been complied with.

MICHIGAN CITY HARBOR, INDIANA.

The inner and outer harbors were formerly separate works. They are now consolidated in consequence of the requirements of the river and harbor act of June 13, 1902.

Inner harbor.—This harbor has been under improvement by the United States since 1836, under a project to dredge the mouth of Trail Creek and to protect its entrance by piers about 100 feet apart. Between 1866 and 1882 the scope of the improvement was gradually enlarged so as to include dredging the creek 120 to 150 feet wide to the crossing of the Lake Erie and Western Railroad, a distance of nearly 2 miles from the entrance, and including two small turning basins, the banks being revetted by the local authorities or riparian owners. Proposed depth of navigation, 15 feet. By authority of the river and harbor act of March 3, 1905, a third turning basin was excavated at the lower bend of the inner harbor, at a cost of not exceeding $25,000.

Outer harbor.—Original project adopted in 1870, amended in 1880, 1882, and 1899; to construct a general harbor of refuge for vessels which may be exposed to storms in the southeastern portion of Lake Michigan. A revised project of 1899 contemplated the removal of the then existing outer western breakwater; the extension of the eastern harbor pier for a distance of 600 feet; the construction of a new detached breakwater, at first to be limited to a length of 1,500 feet, to protect the harbor from westerly storms; and the closing of the entrance to the outer harbor basin, involving the abandonment of the old pier and breakwater structures inclosing the basin on the north and east. Estimated cost of revised project of 1899, $282,150; amended in July, 1903, $312,150.

By joint resolution of Congress approved May 13, 1908 (Public No. 23), the Secretary of War was authorized, in his discretion, to use any unexpended balance of money heretofore appropriated, or that may be hereafter appropriated for the improvement or maintenance of this harbor, for the rebuilding of the western revetment upon a new alignment, with the view of widening the channel.

In accordance with this authorization a new general project was approved by the War Department under date of August 15, 1908, and covers the following items of work:

Widening of inner harbor entrance (building of new pier, removal of old pier, and dredging between)	$72,000
Redredging of inner harbor channel	50,000
Original dredging, upper end of inner harbor	16,000
Completion of exterior breakwater	30,000
Repair, maintenance, and supervision	12,000
Total	180,000

The act of March 3, 1909, appropriated $49,500, which it was intended to apply on the items of approved project, but owing to the extensive damage done by the severe storms of last winter it was necessary to divert $39,500 of this amount toward necessary urgent repairs to the harbor structures and other items of maintenance. This sum of $39,500 so diverted should be replaced by future appropriations in addition to the usual $10,000 per annum required for maintenance. The district officer submitted an estimate amounting to $50,000 for repairs to the outer breakwater alone, rendered necessary by these storms, but a proper regard for other works throughout the country and the limited amount provided by the emergency clause of the act of March 3, 1909, made it inadvisable to allot more than $20,000 for this purpose.

There has been expended on previous projects $1,568,799.26, including $249,670.49 for maintenance; and on the present project (adopted in 1908) $12,947.37, all being for maintenance except $115.

The following work of maintenance was done during the year: Partial repairs were made to the piers and breakwaters; a thorough examination was made of the harbor structures, and contracts were entered into to repair some of the damage caused by the past winter's storms; the gap in the easterly harbor pier was deepened to 6½ feet; the entrance channel was redredged; a contract was entered into for the construction of a new westerly pier and for removal of old pier, but up to the close of the year little progress was made on this work. Negotiations were in progress with the authorities of Michigan City for the acquisition of the land needed for widening the entrance of the harbor, and the deeds therefor will probably be tendered early in the coming year.

All depths are referred to Chicago city datum (low water of 1847), which is 579.94 feet above New York mean tide. The early improvements at this place were referred to the zero of the Michigan City gauge, which is now found to be 581.64 feet above New York mean tide or 3.12 feet above standard low water of lake survey charts.

The head of navigation is at the upper turning basin, a distance of about 2 miles from the end of the westerly pier. The depths vary from 18 to 20 feet from the outer harbor entrance to Franklin Street Bridge; thence from 13 to 14 feet to Eighth street; thence 4 to 5 feet to upper turning basin.

The annual commerce is now reported as 33,448 tons and consists principally of lumber and salt and is steadily decreasing. The local commerce, consisting principally of package freight between Michigan City and Chicago, is steadily increasing, but no accurate record of this tonnage is kept. The passenger travel (summer excursion) is increasing rapidly. Information received as to the effect of the project

on freight rates is meager, but indicates that in a general way the improvement has a tendency to reduce charges and secure advantageous charters for shippers. The city is growing rapidly and steadily.

The funds in hand and those asked for will be expended toward the completion of the approved project and for maintenance and contingencies.

July 1, 1908, balance unexpended		$79,464.51
Amount allotted from appropriation by river and harbor act approved March 3, 1909		49,500.00
Amount allotted from emergency appropriation, river and harbor act of March 3, 1909		20,000.00
		148,964.51
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$115.00	
For maintenance of improvement	12,832.37	
		12,947.37
July 1, 1909, balance unexpended		136,017.14
July 1, 1909, amount covered by uncompleted contracts		93,300.46
Amount (estimated) required for completion of existing project		95,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1909		65,500.00

CALUMET RIVER, ILLINOIS AND INDIANA.

Before improvement of Calumet Harbor by the United States (1870) this river, while having a navigable channel of about 100 feet width and 13 feet depth for about 4 miles length, could not be reached from the lake by boats of over 5 feet draft, because of the bar across its mouth; and its commerce was then practically nothing. At the time of the improvement of the river itself (1884), the river had become navigable for 12 feet draft over widths of about 100 feet and a length of about 4 miles; and for boats of 5 feet draft over widths of about 50 feet and lengths from the river mouth of about 16 miles in the Grand Calumet and about 14 miles in the Little Calumet. The commerce at that time was, however, less than 500,000 tons.

The project for the improvement of this river, adopted by Congress in 1884 and modified in 1886, contemplated securing a channel 200 feet in width and 16 feet in depth below low water in Lake Michigan from the mouth of Calumet Harbor, Illinois, about 11 miles upward, to a point one-half mile east of Hammond, Ind. This project was modified by the river and harbor act of June 3, 1896, for Calumet Harbor, so as to provide for dredging the channel to 20 feet depth from the mouth 2 miles southward (upward).

The projects of 1884 to 1896, now ended, secured a permanent channel of 200 feet width and 20 feet depth from the mouth of the river about 2.5 miles upstream (including a small turning basin near the mouth of the river), thence 16 feet depth about 3 miles farther, except over short portions, where rock reduced the width to 85 feet and the depth to 14 feet; and, in addition, a temporary channel of 10 feet depth and 60 feet width, in the next 6 miles, up to a point on

the Grand Calumet one-half mile east of Hammond, Ind. (about 11 miles above the mouth).

The present projects, adopted by act of March 3, 1905, provided for a channel 200 feet wide and 20 feet deep from the mouth of the river to One hundred and twenty-second street, and of the same width and 16 feet deep from One hundred and twenty-second street to the forks, with five turning basins, at a total estimated cost of $662,480.50, and $10,000 per annum for maintenance. (See p. 605, Annual Report of the Chief of Engineers for 1906.) The construction of the turning basins was made contingent upon the donation of the necessary land to the United States free of cost.

For this work $712,500 has been appropriated, thus providing for the entire project and allowing five years (1905–1910) of maintenance at $10,000 per year.

Under appropriation of August 18, 1894, for "above the forks," $5,050.75 is still available, but dredging has been discontinued because of constant refilling.

The act of June 13, 1902, authorizes the Secretary of War to accept deeds, free of expense to the United States, for lands necessary to make a proper channel 200 feet wide from the forks up to a point one-half mile above Hammond, Ind. (a stretch of about 5.5 miles).

A statement of past examination and survey reports will be found on page 605, Annual Report, 1906, and reference to report on examination made in compliance with act of March 2, 1907, will be found on page 681, Annual Report, 1908.

There has been expended on previous projects $445,768.23, including $41,718.98 for maintenance, and on the present project (adopted in 1905) $413,702.31, of which $3,511.50 was for maintenance; total, $859,470.54.

The following work was accomplished during the year: Under continuing-contract authorization the channel was dredged to a depth of 17 feet and width of 200 feet from a point about 300 feet below the Calumet and Western Railroad bridge for a distance of about 3,200 feet. The excavation of turning basin No. 1, near Ninety-third street, to 650 feet diameter and 21 feet depth was completed. Nothing has been expended for maintenance.

Expenditures up to date have resulted in a channel of 21 feet depth (Chicago datum) from the river mouth to One hundred and sixth street, with 300 feet width at the harbor piers, diminishing to 200 feet width at about Ninety-second street, retaining 200 feet width to One hundred and sixth street (except at bridges); thence 20 feet depth with 200 feet width to One hundred and eleventh street; thence 21 feet depth with 200 feet width to One hundred and fourteenth street; thence 21 feet depth with 180 feet width to One hundred and twenty-second street; thence 17 feet depth with 180 feet width to near the Calumet Western Railroad bridge (near One hundred and twenty-fourth street); thence 17 feet depth and 200 feet width to about 200 feet above the New York, Chicago and St. Louis Railroad bridge; thence about 5 feet mid-channel depth and 100 to 150 feet river width (undredged) to the forks, now under contract to be deepened to 17 feet depth and 200 feet width; thence about 5 feet depth and to about 50 feet width (dredged prior to 1895 to 10 feet depth and to 60 feet width, but since partly filled up) to Hammond, Ind. One turning basin has been dredged just above Ninety-second street with 650 feet least diameter and about 21 feet depth.

The river is further navigable for 6-foot draft boats to Riverdale on the Little Calumet, 12 miles from the river mouth. It can also be used by light-draft launches, such as can pass under bridges, nearly to Gary on the Grand Calumet, about 20 miles from the river mouth, and to Blue Island on the Little Calumet, about 14 miles from the river mouth, being stopped at that point by rapids.

The water level has variations of about 6.5 feet from highest known to lowest known water, and an average of less than 1 foot per day. At dead low water the river is practically level from the lake up to the junction of the Grand and Little Calumet. The current is very slight except during freshet and lake seiches.

Slow progress is being made in the acquisition of lands for widening the river and for turning basins authorized by the acts of June 13, 1902, and March 3, 1905, respectively. All the land for turning basin No. 1 has been acquired and the basin has been dredged. At the close of the year negotiations were well underway toward the acquisition of the necessary lands for turning basin No. 5 and it is expected that the deeds for the same will be tendered early in the coming year. It is reported that deeds will also be tendered for the lands necessary for widening the river between the "forks" and the junction of the Little and Grand Calumet rivers, a distance of about 1.65 miles. Although Congress has authorized the Secretary of War to accept such deeds for lands above the forks, no appropriation has been made for doing the work.

The right of the Sanitary District of Chicago to reverse the flow of Calumet River is still pending in the United States circuit court at Chicago.

The annual commerce has reached 6,000,000 tons, the principal items being iron ore, grain, and coal. It is steadily increasing, and new manufacturing plants are steadily occupying the river banks as fast as the 20-foot depths are carried upstream.

The existence of this improved river is considered to be of great use in controlling freight rates, and is claimed to save at least 50 cents per ton over Chicago River rates, and more over the usual Calumet (South Chicago) railroad rates.

It is proposed to apply the funds now available and those asked for for the year ending June 30, 1911, to continuing the enlargement of the channel progressively upstream according to the 1903 project, adopted by act of March 3, 1905, and to the construction of the turning basins authorized under such project as soon as the land needed therefor be deeded to the United States, and for maintenance.

July 1, 1908, balance unexpended	$357,855.46
Amount appropriated by sundry civil act approved March 4, 1909	30,000.00
	387,855.46
June 30, 1909, amount expended during fiscal year, for works of improvement	83,107.02
July 1, 1909, balance unexpended	304,748.44
July 1, 1909, amount covered by uncompleted contracts	58,049.70
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	20,000.00

Report of the survey presenting the project under which work is now being prosecuted is printed in House Document No. 172, Fifty-eighth Congress, second session; also in Report of the Chief of Engineers for 1904, Part 3, page 2941.

The following is the letter of the Chief of Engineers summarizing the report:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 11, 1903.

SIR: I have the honor to submit herewith reports, dated August 3 and September 16, 1903, with map, by Col. O. H. Ernst, Corps of Engineers, on examination of Calumet River, Illinois and Indiana, ordered by section 1 of the river and harbor act approved June 13, 1902.

Calumet River is now being improved by the General Government under a project to provide a channel 200 feet wide, 20 feet deep (excavating to a depth of 21 feet), to One hundred and twenty-second street (about 4.2 miles from the mouth); 16 feet deep from One hundred and twenty-second street to the forks (about 5.5 miles from the mouth); and 10 feet deep from the forks to a point one-half mile above Hammond (10.5 miles from the mouth). The improvement contemplated by the present examination involves the modification of the existing project so as—

1. To provide a navigable channel 22 feet deep from the mouth to One hundred and sixth street.

2. To include in the improvement the old channel of the river between One hundred and thirteenth and One hundred and sixteenth streets.

With reference to that part of the stream below the forks, Colonel Ernst states that the proposed increase in depth between the mouth and One hundred and sixth street is not required at this time, and that the old bed of the river between One hundred and thirteenth and One hundred and sixteenth streets is of no value to the United States, except that a portion of it at one end might be utilized for a turning basin. In his opinion this section is worthy of improvement by the General Government to the extent proposed by the existing project.

As regards the portion above the forks, he states for reasons given that the work is not worthy to be undertaken by the United States.

Colonel Ernst estimates the cost of projected work at $662,480.50, which includes the excavation of five turning basins having a least diameter of 650 feet, four of them 21 feet deep the other 16 feet deep. The sum of $10,000 will be required annually for maintenance.

This estimate does not provide for the cost of land required for the turning basins estimated to cost $161,342, which the local officer thinks should be given for the purpose free of charge, and he is of opinion that the adoption of this feature of the project should be conditional upon a free right of way.

These reports have been reviewed by the Board of Engineers for Rivers and Harbors under the provisions of section 3 of the said act of June 13, 1902, and attention is invited to its reports on the subject in letter of August 14 and indorsement of November 11, 1903, herewith.

I concur in the views and recommendations of the Board as summarized in its report of November 11, 1903, viz:

"That so much of the site of the former channel between One hundred and thirteenth and One hundred and sixteenth streets as is not needed by the United States for a turning basin be abandoned as navigable waters of the United States, and that the project for the improvement of the Calumet River be this:

"To provide a channel 200 feet wide and 20 feet deep from the mouth of the river to One hundred and twenty-second street, and of the same width and 16 feet deep from One hundred and twenty-second street to the forks, with five turning basins, at a total estimated cost of $662,480.50, and $10,000 per annum for maintenance; and to acquire, as prescribed in the act of June 13, 1902, the land required for a channel 200 feet in width from the forks to a point one-half mile above Hammond, Ind."

Very respectfully, your obedient servant,

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers, U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

Report on a more recent survey is printed in House Document No. 349, Sixtieth Congress, first session. Following is the report of the Board of Engineers:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., December 2, 1907.

Respectfully returned to the Chief of Engineers, U. S. Army.

The within report contains an estimate of cost, amounting to $78,000, for deepening the Calumet River from One hundred and twenty-second street to the forks to a navigable depth of 20 feet, with a turning basin at the forks having a similar depth and a surface diameter of 750 feet.

Having in mind the marked commercial development of this locality in recent years, as explained in the Board's report reviewing that of the district officer on the preliminary examination, the Board is of opinion that the stretch of river under consideration is worthy of further improvement by the United States, and it therefore recommends that the project for the improvement of Calumet River be modified to include the work proposed within.

CALUMET HARBOR, ILLINOIS.

This harbor is known on the Great Lakes as South Chicago Harbor.

Before improvement (1870) this harbor was limited to the lower end of Calumet River and to the natural depths over the bar at its lake mouth, the channel entrance having about 100 feet available width, with about 4 feet depth. The annual commerce was practically nothing in either harbor or river. A brief history of this harbor improvement prior to 1876 is given on pages 441–444, part 2, Annual Report of the Chief of Engineers for 1876; and a very full description of present conditions is to be found on pages 124–125, Bulletin No. 18 (1908), issued by the United States Lake Survey Office, Detroit, Mich.

This improvement was designed to furnish a safe and practicable entrance to Calumet River and the port of South Chicago by the construction of parallel piers 300 feet apart, projecting from the shore into Lake Michigan, and by dredging between them.

The work began in 1870, and all the projected work for 16 feet draft was accomplished prior to June 30, 1896, resulting in the construction of 3,640 linear feet of north pier and 2,020 linear feet of south pier, and securing and maintaining a channel 16 feet deep and of suitable width from water of similar depth in Lake Michigan to the Calumet River at the roots of the piers, at a cost of $454,483.53.

The present project, submitted February 21, 1896, and specifically adopted by Congress by act of March 3, 1899 (including minor changes submitted March 28, 1899, modified July 1, 1902, and approved by Secretary of War July 11, 1902), provides for—

(*a*) A breakwater 4,400 feet long, connected with the shore and running due east into the lake, terminating in water 32 feet deep.

(*b*) An extension of this breakwater 2,500 feet long in a southeasterly direction from the end of the first.

(*c*) The anchorage area sheltered by breakwater dredged to 20 feet draft (21 feet depth).

(*d*) South pier at the mouth of Calumet River extended 800 feet.

(*e*) The Calumet River dredged to a width of 200 feet and 20 feet draft (21 feet depth) for a distance of 2 miles from the mouth.

(*f*) Maintenance and repairs.

For text and map, including minor changes, see pages 2583–2588, Annual Report of the Chief of Engineers for 1896, and page 2102 of the report for 1902.

A statement of past examination and survey reports will be found on page 603, Annual Report of the Chief of Engineers for 1906.

There has been expended on previous projects $454,484.53, and on the present project of 1896, adopted in 1899, $1,024,259.91, of which $39,180.95 was for maintenance; total, $1,478,744.44.

The operations during the year consisted of maintenance, considerable repair work having been made necessary by damage to breakwaters by storms.

All original work of past and existing projects has now been completed, leaving since 1905 only its repair and other maintenance.

At present the protected harbor behind the lake breakwater is about one-half square mile in area, with 20 feet depth; and the pier entrance to the river is of 300 feet width, with at least 20 feet channel depth; all depths being referred to Chicago city datum. (See Chicago Harbor report.)

Recent soundings indicate that some shoaling has occurred in the protected area. Considerable further damage has been done to the breakwater structures by storms of the past winter. About 900 feet of the north pier and about 300 feet of the south pier are in a very dilapidated and rotten condition and must soon be rebuilt, as these structures have now exceeded by several years the customary life of such structures. When the rebuilding is done, concrete construction should be used.

The water level has a total variation of about 6.5 feet from the highest known to lowest known water, and an average of less than 1 foot oscillation per day.

Calumet Harbor, being mainly a protection to Calumet River entrance, has practically no commerce except that of Calumet River, although about half of the Illinois Steel Company's commerce, belonging partly to the harbor and partly to the river and estimated herewith, as usual, under Calumet River, belongs strictly to the harbor. The harbor works are fully entitled to half the credit of all the commerce developed by the combined harbor and river improvements since 1870, such development having now reached about 6,000,000 tons annually.

The existence of this improved harbor is considered to be of great use in controlling freight rates, and is claimed to save at least 50 cents per ton over Chicago River rates, and more over the usual Calumet (South Chicago) railroad rates.

It is proposed to apply the funds now available and the additional appropriation recommended to the necessary repair and other maintenance of the works.

July 1, 1908, balance unexpended	$110,508.37
June 30, 1909, amount expended during fiscal year for maintenance of improvement	22,021.81
July 1, 1909, balance unexpended	88,486.56
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	30,000.00

CHICAGO HARBOR, ILLINOIS.

Before improvement (1870) this harbor was limited to the lower end of Chicago River, with an entrance channel width of 400 feet, depth 13 feet, and annual commerce less than 3,000,000 tons. A brief history of this harbor improvement prior to 1876 is given on pages 433 to 438, Part 2, Annual Report of the Chief of Engineers for 1876, and a very full description of the harbor in its improved condition is to be found on pages 131 to 134, Bulletin No. 18 (1908), issued by the United States Lake Survey Office, Detroit, Mich.

The present project was adopted in 1870, modified in 1878, 1896, 1903, and 1905; that for present increased depth of dredging in outer harbor being given by report of July 16, 1897 (p. 2791, Annual Report of the Chief of Engineers for 1897), specifically adopted by act of March 3, 1899; and that for repair of north pier being given by report of July 14, 1903 (p. 1888, Annual Report of the Chief of Engineers for 1903), adopted by act of March 3, 1905; such projects including:

(*a*1) Breakwaters to form an outer harbor, with (*a*2) dredging within the same for 20-foot draft (21 foot depth).

(*b*) Exterior breakwater, with a harbor of refuge behind the same.

(*c*) Dredging entrance to inner harbor or mouth of Chicago River to same depth as outer harbor.

(*d*) Maintenance; including (*d*1) the special repair of north pier superstructure and (*d*2) some redredging outside the southern entrance to the basin.

(*e*) Contingencies, including superintendence.

For map of full improvement, see page 1888, Annual Report of the Chief of Engineers for 1903.

No preliminary examination reports appear to be on record as to past improvements of this locality.

A list of past survey reports will be found on page 600, Annual Report of the Chief of Engineers for 1906.

There has been expended on projects prior to 1870, $446,005, and on the project of 1870, with its modifications, to June 30, 1909, the sum of $2,106,687.37; total, $2,552,692.37.

The operations during the year were: Completion of the concrete superstructure over the north pier; completion of pile protection pier at United States life-saving station and United States engineer boathouse (one-half of the cost of which was paid for by the Life-Saving Service); redredging the channel from the lake to Rush Street Bridge; repairs to north end of easterly breakwater. All of the work above mentioned is that of maintenance except the construction of the small protection pier at the life-saving station.

The uncompleted portions of the above project now are (*a*2) completion of dredging of the outer harbor basin for a 20-foot draft, estimated July 16, 1897, at $509,960; (*d*2) reopening (dredging) of the east (also called southern) entrance to the outer harbor basin; (*d*4) repair of outer harbor breakwater cribs and filling; (*d*5) repair of exterior harbor of refuge breakwater; (*e*) contingencies, including superintendence.

At present the harbor entrance has a width of 470 feet at the river mouth, with a least depth of 21 feet via Chicago River, and of about 16 feet via the basin entrance; and the harbor basin carries depths of

at least 19 to 20 feet over its outer half and of at least 8 feet over its inner half; all these depths being referred to "Chicago city datum," or the so-called "low water of 1847," which is 579.83 feet above mean tide, New York Harbor (Lake Survey revisions of 1907).

The water level has a total variation of about 6.5 feet from highest known to lowest known water, and an average of less than 1 foot oscillation per day.

Chicago outer harbor, being mainly a protection to Chicago River entrance, has practically no commerce except that of the river, the outer basin being used mainly by yachts and other small craft. The lake commerce of this locality is at present diminishing and the harbor works, while formerly having added about 5,000,000 tons to the river commerce, are now needed mainly to prevent a more rapid loss of the 4,000,000 tons remaining.

The existence of this improved harbor is considered to be of great use in controlling freight rates.

By act approved May 28, 1908 (Public, No. 153), any or all of the then available balance for Chicago Harbor was made available, in the discretion of the Secretary of War, for expenditure on the existing project for Chicago River, and under this authority $193,000 of Chicago Harbor funds has been transferred to Chicago River.

The superstructures of the easterly and southerly breakwaters have deteriorated to such an extent that rebuilding in concrete is now considered necessary, and the cost thereof is included in the amount that can be profitably expended in the fiscal year ending June 30, 1911.

It is proposed to apply the available funds and those asked for the fiscal year ending June 30, 1911, to the maintenance of existing works, redredging the southern entrance to the outer harbor, and rebuilding in concrete the superstructures of the easterly and southerly breakwaters, meanwhile postponing the completion of the outer basin dredging, which is not considered urgent.

By the act of March 3, 1909, Congress ordered an examination to be made of the rivers and harbors in the Chicago district for the purpose of reporting a plan for a complete, systematic, and broad improvement of harbor facilities for Chicago and adjacent territory. This report will be submitted to Congress at the second session Sixty-first Congress.

July 1, 1908, balance unexpended		$279,426.01
Amount transferred to Chicago River		193,000.00
		86,426.01
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$4,678.89	
For maintenance of improvement	45,498.03	
		50,176.92
July 1, 1909, balance unexpended		36,249.09
Amount (estimated) required for completion of existing project		237,960.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		480,000.00

WAUKEGAN HARBOR, ILLINOIS.

Originally there was no navigable channel or natural harbor at this place.

An appropriation of $15,000 was made in 1852 "for the improvement of the harbor and breakwater at Waukegan, Ill." The plan adopted was the construction of a breakwater parallel to the shore in about 20 feet of water and opposite the heads of two bridge piers in the open lake, from which the commerce of the place was carried on. One crib was placed in position, but was carried away by a storm, and the work was abandoned.

The original project was adopted in 1880 and provided for an artificial harbor of sufficient capacity for local trade by inclosing an area with pile piers, the entrance channel and inclosed area to be dredged 13 feet. The amount expended on original project prior to commencement of operations under present project was $218,944.41.

The existing project, adopted by act of June 13, 1902, provides for extending both harbor piers, building a breakwater, and increasing depth of channel to 20 feet; estimated cost, $345,000, all of which has been appropriated.

The total amount expended in the work of existing project up to the close of the fiscal year ending June 30, 1909, is $400,981.38; of this sum $90,641.99 was for maintenance, of which amount $72.93 was derived from miscellaneous sources.

The expenditures during the fiscal year have been for reconstruction of inshore end of south pier, and dredging for restoration of channel, and minor repairs of breakwater, repairs of plant, and for general supervision. The new south pier is practically completed, and the harbor has been dredged.

The approved project was completed in 1904. Since then all expenditures have been for maintenance.

The maximum draft which could be carried June 30, 1909, was about 19 feet. The usual mean annual variation of water level is about 1 foot.

Commercial statistics for 1908.—Arrivals of vessels, 660; shipments and receipts, 217,009 net tons. The approximate value of the exports and imports could not be ascertained.

The commerce affected by the project is mostly coal and salt for transshipment. Its volume is large and increasing.

It is believed that the harbor is of great convenience to general commerce, being a terminus of the Elgin, Joliet and Eastern Railway, known as the Chicago Outer Belt Line. The harbor is in close connection with all the railways entering Chicago.

It is believed that the project has a considerable effect in controlling freight rates on coal and other bulk commodities.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, in repairs of piers and breakwater and dredging. The work proposed is necessary for maintenance of the harbor.

For reference to more extended information, maps, and reports on examinations and surveys, see Annual Report for 1904, page 532.

July 1, 1908, balance unexpended	$50,275.37
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	55,275.37
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	24,628.23
July 1, 1909, balance unexpended	30,647.14
July 1, 1909, amount covered by uncompleted contracts	16,365.62
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

CHICAGO RIVER, ILLINOIS.

Before improvement by the United States (1896) the river channel, as a result of municipal and private improvements, was navigable for about 14-foot draft boats over widths of about 200 feet throughout the length of the main river, about 1.5 miles, and of use by boats of 12 to 14 feet draft for lesser widths and for about 5 miles farther length in the North Branch and about 5 miles farther length in the South Branch and forks. A good brief history of river and harbor improvement at Chicago prior to 1876 is given on pages 433–438, Part 2, Annual Report of the Chief of Engineers for 1876, and a very full description of present conditions is to be found on pages 134–144, Bulletin No. 18 (1908), issued by the United States Lake Survey Office, Detroit, Mich. For maps of river and turning basins, see pages 1892–1893, Annual Report, 1903.

Past projects, from 1896 to 1902, provided for 16 feet draft through this river. Under such projects 17 feet actual depth below city datum was secured from the mouth of the river via South Branch and West Fork to Ashland avenue (about 5.5 miles), via South Branch and South Fork to the stock yards (about 6 miles), and via North Branch to Belmont avenue (about 6 miles). (See p. 2974, Annual Report of the Chief of Engineers for 1893; p. 2793, Report for 1897, and p. 3865, Report for 1900, for full reports on history of improvement and needs up to 1899.)

The project of July 2, 1902, estimated cost $500,000, as specifically covered by act of Congress June 13, 1902, provided for two large turning basins (one in the North Branch and one in the South Branch), to be dredged to 20 feet draft (21 feet depth). These turning basins have been completely dredged and partly docked, but will need some annual redredging and probably some further dock revetment.

The river and harbor act, March 2, 1907, appropriated $300,000 for improvement and maintenance of this river, such work being covered by the survey report of November 14, 1899 (pp. 3865–3871, Annual Report of the Chief of Engineers for 1900), and providing for dredging to 21 feet actual depth in mid-channel and to within 20 feet of dock lines from Ogden slip at the river mouth to Ashland avenue on the South Branch, to the Indiana state line bridges on the South Fork, South Branch, and to Belmont avenue on the North Branch (including also the canal around Goose Island, North Branch), all

originally estimated at $810,600. Project covering this work was approved April 11, 1908, as follows:

(*a*) Dredging soft material, main river, North Branch (including canal), South Fork of South Branch, 1,472,000 cubic yards	$384,000
(*b*) Excavation rock and hardpan in North Branch and South Fork, 105,000 cubic yards	352,800
(*c*) Superintendence and inspection	73,800
	810,600

the division of funds between dredging and excavation being subject to modification during the progress of work.

A list of past survey reports will be found on page 601, Annual Report of the Chief of Engineers for 1906.

Refetence to reports on examination and survey of West Fork of South Branch of Chicago River, ordered by the river and harbor act of March 3, 1905, will be found on page 608, Annual Report of the Chief of Engineers for 1906. A new report on the same locality was called for by the river and harbor act of March 3, 1909, and is printed in House Document No. 392, Sixty-first Congress, second session.

The head of navigation of the river and its branches, together with a statement of its navigable lengths, are given in the following table:

	Miles.
Main river from end of piers to junction of branches	1.58
South branch to Ashland avenue	4.08
South Fork of South Branch to Chicago Junction Railway bridges	1.71
North Branch to Belmont avenue	5.14
North Branch Canal (Goose Island Cut-off)	1.04
Total	13.55

There has been expended on previous projects $929,899.14 (of which $3,326.99 was for maintenance during the present fiscal year), and on the present project, approved April 11, 1908, $309,266.97; total, $1,239,166.11.

The following work was accomplished during the year: 484 linear feet of dock built in the South Branch turning basin; main river deepened to project depth from Rush Street Bridge to the forks; North Branch, including North Branch Canal, dredged to project depth to 900 feet north of Clybourn place; South Fork, South Branch, dredged to project depth from the South Branch turning basin at Fuller street to the junction with its west arm. Nothing has been expended for maintenance.

At present the river, including both branches, slightly widened at its narrowest parts by the United States and much widened in the South Branch by the Chicago Sanitary District, has a least depth of channel, as referred to Chicago city datum, of 21 feet from the lake to the forks; thence in the North Branch 21 feet, including North Branch Canal, to 900 feet north of Clybourn place, thence 8 feet to Fullerton avenue, thence 7 feet to Belmont avenue; and in the South Branch 21 feet to the junction with its west arm, except at Archer avenue, where the city's water-pipe tunnel restricts the depth to 19 feet below hydraulic grade. (For general description of the sanitary district projects, see p. 2097, Annual Report of the Chief of Engineers for 1902.)

The water level has variations of about 6.5 feet from the highest known to lowest known water, and an average of less than 1 foot per

day. The river has a current from the lake toward the Sanitary District Canal varying from nothing up to about 3 miles per hour, according to drainage diversion and lake seiches.

The annual commerce is now reported at about 4,000,000 tons, the principal items being grain, lumber, coal, and salt (a good deal of commerce having, since 1897, gone to the Calumet River), and the present further improvement is now mainly needed to prevent further loss. There is quite a large local commerce carried in the Chicago River by lighters, of which no official record is kept.

The development of commerce on this river is greatly hampered by the many obstructive bridges crossing the stream, which are owned by the city of Chicago.

The existence of this improved river is considered to be of great use in controlling freight rates.

By act approved May 28, 1908 (Public—No. 153), any or all of the available balance for Chicago Harbor was made available, in the discretion of the Secretary of War, for expenditure on the existing project for Chicago River, and under this authority $193,000 of Chicago Harbor funds was transferred to Chicago River.

It is proposed to apply the funds now available and further appropriations to the completion of the turning basins, to the securing of the new 21-foot depth throughout the river, and to the maintenance of existing works.

July 1, 1908, balance unexpended		$341,847.58
Transferred from Chicago Harbor		193,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909		5,000.00
		539,847.58
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$319,508.58	
For maintenance of improvement	3,326.99	
		322,835.57
July 1, 1909, balance unexpended		217,012.01
July 1, 1909, outstanding liabilities		13,000.00
July 1, 1909, balance available		204,012.01
July 1, 1909, amount covered by uncompleted contracts		134,609.51
Amount (estimated) required for completion of existing project		317,600.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		332,600.00

ILLINOIS AND MISSISSIPPI CANAL.

Following is the letter of the Chief of Engineers submitting report on an examination, printed in House Document No. 126, Fifty-sixth Congress, second session; also in Report of Chief of Engineers for 1901, Part 4, page 3066:

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, November 30, 1900.

SIR: I have the honor to submit herewith for transmission to Congress copy of report, dated October 19, 1900, by Maj. J. H. Willard, Corps of Engineers, upon preliminary examination authorized by the emergency river and harbor act approved June 6, 1900, as follows:

The dam in Rock River referred to is already provided for in connection with the feeder line for the Illinois and Mississippi Canal now being constructed under the con-

tinuing-contract system, and the insertion of a lock in the dam is desired by the citizens of the cities of Sterling and Rockfalls, with a view to extending the navigation that may take place through the canal and over that portion of the river above the dam down to and along the river fronts of the business portions of both cities. In the opinion of the local officer the work is worthy of being undertaken by the United States, and an estimate of its cost is submitted, amounting to $75,000. Further surveys are not necessary at this time.

In view of the fact that the proposed work is so closely identified with that of the canal and feeder line now under way, I would respectfully recommend that, if the improvement be authorized by Congress, the project and estimate for the Illinois and Mississippi Canal be extended to include the additional features now presented, rather than that they be treated as a separate and distinct project.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers, U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

ILLINOIS RIVER, ILLINOIS.

(*a*) *Below Copperas Creek.*—The project, which contemplates the extension of slack-water improvement begun by the State of Illinois from Copperas Creek lock to the Mississippi River, and which includes the construction of two locks 350 feet long between sills, 75 feet width of chamber, with 7 feet of water over sills at low-water level of 1879, and dredging the channel where necessary to obtain 7 feet depth at low water, was adopted in 1880.

The lock and dam at Kampsville, Ill., 31 miles above the mouth of Illinois River, has been completed and in use since 1894, and that at La Grange, 79 miles above the mouth, since 1890.

The State of Illinois, aided by the United States, has executed part of the general project by the construction of locks and dams at Henry and at Copperas Creek, completing, except dredging, that part of the project between La Salle and the mouth of Copperas Creek, a distance of about 90 miles, over which section the State of Illinois collects tolls.

Harbor lines on both sides of the river at Peoria have been established.

The United States has expended on this work to June 30, 1909, $1,539,805.93, of which $13,616.94 was expended during the fiscal year in maintenance of plant and rebuilding same, dredging, snagging, and supervision of the river and care of property and plant.

The improvement of Illinois River has been in progress many years, and the present navigable depth has obtained at ordinary stages of the river for several years, during which freight rates in the vicinity have decreased to some extent; but as freight rates generally have diminished during these years, it is impossible to state whether the effect of river competition is shown in diminished railroad freight rates. The closing of the river to navigation, however, would unquestionably lead to a rise in freight rates on the adjacent railways, and as the volume of freight affected would be large a good navigable condition should be maintained.

There are many wagon bridges and railroad bridges across the river, and at Peoria the troughs of large distilleries discharge into the channel; these structures have been modified from time to time to meet the demands of navigation.

It is proposed to apply the available fund and the appropriation recommended toward maintaining the navigable channel of 7 feet

depth, removing snags, dredging, care and repair and rebuilding plant, and such local surveys as may be necessary from time to time.

July 1, 1908, balance unexpended		$60,728.32
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$10,000.00	
For maintenance of improvement	3,616.94	
		13,616.94
July 1, 1909, balance unexpended		47,111.38
July 1, 1909, outstanding liabilities		500.00
July 1, 1909, balance available		46,611.38
Amount (estimated) required for completion of existing project		142,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		50,000.00

(*b*) *From Copperas Creek to La Salle.*—The first appropriation for this section of the river was made March 2, 1907, and the approved project for its expenditure provides for securing the same navigable conditions from Copperas Creek to La Salle as are planned for the lower river, i. e., a channel depth of 7 feet at low water.

Operations have consisted in snagging, supervision, and repairs and additions to plant for dredging purposes; surveys have been made to locate shoal points and bars. The stage of water has been too high to render dredging either practicable or necessary. Work on this section of the river is to be carried on with the same plant used on the lower section.

The amount expended on this work to June 30, 1909, is $12,997.41, of which $4,604.67 was expended during the fiscal year.

It is proposed to apply the available funds to securing and maintaining a navigable channel of 7 feet depth, snagging, care, and repair of property and plant, inspection and prevention of obstructions and encroachments, and such local surveys as may be necessary

July 1, 1908, balance unexpended	$41,607.26
June 30, 1909, amount expended during fiscal year, for works of improvement	4,604.67
July 1, 1909, balance unexpended	37,002.59
July 1, 1909, outstanding liabilities	300.00
July 1, 1909, balance available	36,702.59

MISSISSIPPI RIVER COMMISSION.

The Mississippi River Commission, constituted by act of Congress of June 28, 1879, is in charge of the improvement of the Mississippi River from Head of Passes to the mouth of the Ohio River, including the rectification of Red and Atchafalaya rivers at their junction with the Mississippi, the building of levees, and the improvement of the several harbors for which specific appropriations have been made, with the exception of the harbor of Vicksburg and the mouth of Yazoo River. It is also charged with the survey of the Mississippi River from Head of Passes to its headwaters, and with gauging the river and its tributaries.

The river and harbor acts of March 3, 1905, and March 2, 1907, prescribed that the money therein appropriated and authorized to be

expended should be applied to the construction of suitable and necessary dredge boats and other devices and appliances and in the maintenance and operation of the same, with the view of ultimately obtaining and maintaining a navigable channel from Cairo down not less than 250 feet in width and 9 feet in depth at all periods of the year, except when navigation is closed by ice. They also authorized allotments from such funds in the discretion of the Commission and upon approval by the Chief of Engineers, to be applied to the water courses connected with the river and the harbors upon it now under the control of the Mississippi River Commission.

Act of Congress approved June 4, 1906, provides that any funds which have been, or may hereafter be, appropriated by Congress for improving the Mississippi River between the Head of Passes and the mouth of the Ohio River, and which may be allotted to levees, may be expended under the direction of the Secretary of War, in accordance with the plans, specifications, and recommendations of the Mississippi River Commission, as approved by the Chief of Engineers, upon levees upon any part of said river between the Head of Passes and Cape Girardeau, Mo.

The act of March 2, 1907, provided for prosecution of the work under continuing contract and authorized expenditures in the sum of $6,000,000 (of which $2,000,000 yet remains to be appropriated), provided that this sum shall be used in improvement for not less than three years, the work done each year to cost approximately $2,000,000.

The commissioners during the past fiscal year were Col. Wm. H. Bixby, Corps of Engineers, president; Col. Wm. T. Rossell, Corps of Engineers; Lieut. Col. J. G. Warren, Corps of Engineers; Homer P. Ritter, assistant, United States Coast and Geodetic Survey; Robert S. Taylor, J. A. Ockerson, and Henry B. Richardson.

Capt. G. R. Lukesh, Corps of Engineers, was on duty as secretary to the commission to November 30, 1908, and First Lieut. C. H. Knight, Corps of Engineers, since that date.

Estimate for the fiscal year ending June 30, 1911.—The following estimate of funds required for carrying on the works under its charge for the year ending June 30, 1911, is submitted by the commission:

For continuing the improvement of Mississippi River from Head of Passes to the mouth of the Ohio River, including salaries and clerical, office, traveling, and miscellaneous expenses of the Mississippi River Commission..... $4,000,000

The estimate has been reduced in the office of the Chief of Engineers to $2,000,000, this being the limit of expenditure at present authorized by Congress.

MISSISSIPPI RIVER BETWEEN OHIO AND MISSOURI RIVERS.

The project adopted for the permanent improvement of the Mississippi River between the mouths of the Ohio and Missouri rivers was approved by the Chief of Engineers, United States Army, March 31, 1881. The estimate of the cost, as revised in 1883, was $16,397,500. The project was modified by the river and harbor act of June 3, 1896, to permit the construction and operation of dredges. It was again modified to some extent in 1903 by the Board of Engineers for Rivers and Harbors in report dated November 12, 1903, the

dredging recommendation of which was adopted by Congress in the river and harbor act of March 3, 1905, as the principal means of improvement.

By the report of 1903 the cost is increased $20,000,000 in addition to expenditures already made, provided the projects in force be adhered to throughout. The cash expenditures to December 31, 1903, are considered as approximately the cost of the work up to the date of the report of the Board. They were $10,476,654.53. The total estimated cost as last revised is therefore $30,476,654.53.

The total amount appropriated to June 30, 1909, was $13,144,999.98. Of this amount $180,000 was allotted by acts and projects for improvement between the Illinois and Missouri rivers, including Alton Harbor, leaving a balance of $12,964,999.98 to be applied to the project for the general improvement between the mouths of the Ohio and Missouri rivers. The balance of the last revised estimate not appropriated June 30, 1909, is therefore $17,511,654.55.

Estimate of additional funds required.

Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909:

For existing constructions	$400,000	
For dredged channels	250,000	
		$650,000

MISSISSIPPI RIVER BETWEEN MISSOURI RIVER AND MINNEAPOLIS.

The following is printed in House Document No. 341, Fifty-ninth Congress, second session:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 20, 1906.

SIR: The river and harbor act approved March 3, 1905, under item for improving Mississippi River between the Missouri River and St. Paul, Minn., provides as follows: "And the Secretary of War may cause an estimate to be made of the cost of securing a channel 6 feet deep in that portion of the river above described." Such an estimate has been prepared and is given in the accompanying reports of Maj. C. S. Riché, Corps of Engineers, and Assistant Engineer C. W. Durham, which are submitted for transmission to Congress.

The estimate of cost presented, including work on the Rock Island and Des Moines rapids, is $20,000,000.

The project now being executed provides for a progressive improvement, with a view to securing at first a 4½-foot channel throughout the river at low water, to be gradually increased to 6 feet.

Very respectfully,

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

MISSISSIPPI RIVER BETWEEN MISSOURI RIVER AND ST. PAUL, MINN.

UNITED STATES ENGINEER OFFICE,
Rock Island, Ill., October 1, 1906.

GENERAL: The river and harbor act of March 3, 1905, provides, under head of improving Mississippi River between Missouri River and St. Paul, Minn., that "the Secretary of War may cause an estimate to be made of the cost of securing a channel 6 feet deep in that portion of the river above described." By department letter of March 14, 1905, the duty of preparing the required estimate was assigned to me. This estimate has been prepared under my direction by principal Assistant Engineer C. W. Durham, who has had thirty-five years' experience on the upper Mississippi River on

surveys, projects, estimates, construction work, and snag-boat operations, and whose report, accompanied by 52 sheets of drawings, * * * is inclosed.

It appears that, prior to the inauguration of systematic river regulation under annual appropriations, considerable temporary and experimental improvement work was performed, all of which was in a measure successful, although not lasting in its effects, and all of which demonstrated the expediency of contraction as the prime factor in successful work. The permanent and systematic improvement of the river was inaugurated in 1878 and has continued to the present time. The original project, which has so far undergone no material change, was adoped in 1878, making use of the principle of contraction in the closure of chutes, construction of wing dams, and revetment of caving banks to such a degree as to obtain a channel of a depth of 4½ feet at low water, to be eventually increased to 6 feet by further contraction. No definite estimate was presented, but up to the present time about $10,200,000 has been expended for channel improvement with very satisfactory results; in fact, the methods employed have been so successful wherever the full regulation has been carried out, and also in most cases of partial regulation, that it is believed a further narrowing of the waterway will bring about a still further increase in depth and secure the 6-foot channel desired. It is to be noted that up to the present time no perceptible raising of the bed of the stream has occurred at any locality, a very favorable indication of permanency of the improvements. The operation of snag boats in the removal of fixed obstructions, such as snags, wrecks, rocks, impending trees, etc., is already provided for by permanent appropriations, and nothing for such work is included in the estimate.

The projected channel widths of the provisional 4½-foot project of 1897, under which work has been carried on during late years, are changed as follows in the 6-foot project: St. Paul to mouth of St. Croix River, from 400 to 300 feet; St. Croix River to head of Lake Pepin, where the projected channel is in both instances 600 feet in width, requires no change, as the present contraction has already secured the 6 feet desired; Lake Pepin to Alma, from 800 to 525 feet; Alma to Genoa, 800 to 625 feet; Genoa to Wisconsin River, 800 to 700 feet; Wisconsin River to Rock Island Rapids, 1,000 to 900 feet; Rock Island to Des Moines Rapids, 1,200 to 1,000 feet; Keokuk to Hannibal, 1,200 to 1,000 feet; Hannibal to the Illinois River, 1,300 and 1,400 to 1,200 feet, and from the Illinois River to the Missouri River, 1,600 to 1,400 feet. At the Rock Island Rapids a lateral canal is proposed, and at the Des Moines Rapids a deepening of the existing canal.

The 6-foot project and estimate presented not only calls for the protection of caving banks and for channel contraction by means of wing, closing, and trailing dams of brush and rock, but also includes repairs to existing improvements and maintenance during construction, and provides for auxiliary dredging. The estimate aggregates $20,000,000, and it is believed that, as explained by Mr. Durham in his report, the cost will be about the same for a ten, fifteen, or twenty year period, the required amounts per annum for carrying out the work being $2,000,000, $1,333,334, and $1,000,000, respectively. The care and maintenance of the entire improvement after completion is estimated at $300,000 a year. The detailed plans and estimate presented accord with my views and are concurred in, it being understood that the location of dams, etc., is subject to change with the altering conditions of the river.

As regards the auxiliary dredging, the amount to be done is more or less uncertain and will depend on various circumstances, but it is to be carried on coincidently with the building of the dams to facilitate the scour or movement of the sand and to dispose of it to the best advantage.

It is not considered practicable to secure and maintain by dredging alone a permanent improvement with a 6-foot depth of channel. Former dredging in the upper Mississippi, although temporarily of good effect, has generally failed through lack of permanency, and such permanency can be best obtained by contracting dams, and to such an extent as to make the dams primary, the dredging secondary or auxiliary. The lower Mississippi River, in which improvement by dredging is the plan now adopted, differs much from the stream above the mouth of the Missouri. The lower river has fewer obstructing bars; but permanent dams, whether closing dams or wings, are very expensive and are difficult to build and maintain, so that powerful dredges, in a sufficient but not very large number, may be able to forestall trouble on the approach of low water and temporarily improve the bad places without seriously interfering with navigation, and probably at less ultimate expense. In the upper river, between the mouth of the Missouri and St. Paul, there are 227 bars or bad crossings, of which a record has been kept for many years, and all or most of these bars are liable, at recurrence of low stages, to interrupt the 6-foot channel navigation. As a dredge would necessarily be employed for at least a week to improve a single bar, it is evident that even with a very large number of dredges 6-foot navigation would be exceedingly difficult and precarious at low water, if not entirely impracticable. It can, therefore,

be readily seen that the proposed dams, built and maintained at a very small cost as compared with those in the lower river, will in a short time, if sufficient funds are furnished, permanently overcome the obstacles, and with a comparatively small amount of auxiliary dredging afford the improvement desired.

The method of improvement by contraction by means of wing dams and shore protection, with auxiliary dredging, is recommended in preference to other methods, not only because of its less cost but also because it permits open-channel navigation, which is greatly to be preferred for rafts and large tows. It would, of course, be feasible to improve the river by canalization by locks and movable dams, but the cost would be very great, certainly in excess of $30,000,000. An improvement by means of a lateral canal might also be made, but this would cost even more, and operation and maintenance charges would be excessive.

There is forwarded with this letter a tracing showing an index or outline map of the Mississippi River from St. Paul to the mouth of the Missouri River, and also giving a condensed estimate, by divisions, of the cost of the improvement proposed to secure a 6-foot channel.

Very respectfully, your obedient servant,

C. S. RICHÉ,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

WATERWAY FROM LOCKPORT TO THE MOUTH OF THE ILLINOIS RIVER.

The following is from the report of the House Committee on Rivers and Harbors:

The bill provides for the appointment of a board of engineers to consider, among other things, the advisability of cooperating with the State of Illinois in the improvement of a waterway by way of the Desplaines and Illinois rivers from Lockport to the mouth of the Illinois River. In 1902 a board was appointed for the purpose of making an estimate of the cost of a 14-foot waterway from Lockport to St. Louis. This board reported in 1905, estimating the cost from Lockport to Grafton at $23,543,582, and from Grafton to St. Louis, $6,553,880, being a total of $30,097,462. The plans of the board covering the Illinois and Desplaines rivers contemplated the canalization of the river from Lockport to Utica by 9 locks and 5 movable dams, the utilization of the open Illinois River from Utica to Grafton by removing the 4 existing dams and dredging the channel proposed by this board and connecting with the Chicago drainage canal by a lock already built in the dam constructed for the sanitary district of Chicago at Lockport.

This report contained no recommendations as to the advisability of undertaking the project, because such opinion was not called for in the act ordering the survey, but after it was reported to Congress the River and Harbor Committee by resolution referred it to the board of review, which reported against its advisabilty on account of cost and the depth of water, but stated that it "believes that the commercial interests of the Great Lakes are entitled to an outlet to the Gulf of Mexico of as great a capacity as can be obtained at a reasonable cost."

In accordance with the river and harbor act of 1907, a board was appointed to examine the Mississippi River below St. Louis and report as to the practicability and desirability of constructing and maintaining a channel 14 feet deep from St. Louis to the mouth of the river, the law providing that this board should consider in connection with such examination the survey of the route from Chicago to St. Louis, reported upon in 1905, as stated above.

This board concluded that it was practicable to obtain a depth of 14 feet from St. Louis to the mouth of the Mississippi River at a total cost of approximately $128,600,000, This sum and the $30,097,462 estimated by the board of 1905 for the 14-foot waterway between Lockport and St. Louis would make a total for a 14-foot waterway from Lake Michigan to the Gulf of Mexico of $158,697,462. The report of this special board was referred, as required by law, to the board of review, which agreed with the special board that it is not desirable to construct a channel 14 feet deep, and that the present demands of commerce between St. Louis and the mouth of the Mississippi River are adequately met by the existing projects of 8 feet depth from St. Louis to the mouth of the Ohio and 9 feet thence to the Gulf of Mexico. The board of review stated, moreover, that it believed a waterway 8 feet deep from Chicago to St. Louis, to correspond with the present project from St. Louis to Cairo, would be desirable, having in view the demands of the commerce of to-day, provided its cost is reasonable, and that both present and prospective commerce would be adequately served by a through channel 9 feet in depth.

From this statement of fact it appears that the Engineer Board of Review not only expressed the belief in its report in 1907 "that the commercial interests of the Great Lakes are entitled to an outlet to the Gulf of as great capacity as can be obtained at reasonable cost," but added, in its report of 1909, that a waterway 8 feet deep from Chicago to St. Louis, to correspond with the present project from St. Louis to Cairo, would be desirable, provided its cost is reasonable. In view of this, and the further fact that the people of Illinois have now authorized their general assembly to appropriate $20,000,000 for the construction of a suitable navigable waterway from Lockport to the mouth of the Illinois in conjunction with the development of water power, the committee recognizes the importance of ascertaining, by means of a new board, to what extent the United States may properly cooperate with the State of Illinois in securing the construction of a suitable waterway through the Illinois River.

The United States has heretofore generously cooperated with other localities, notably in the case of Cold Spring Inlet in New Jersey, carried in the bill of 1907. There are also in the present bill 21 items in which appropriations are made dependent upon contributions by local interests.

In providing for a board to consider the question of cooperation, the committee has followed the usual course of procedure. In 1902 the river and harbor bill provided for the so-called Ernst board, which was authorized to make an estimate of the cost of a 14-foot waterway from Lockport to St. Louis. Again in 1907 this committee, in the bill of that year, provided for the so-called Bixby board, which was directed, among other things, also to consider the route from Lockport to St. Louis. It was the latter board that reported in 1909 adversely to a 14-foot waterway.

Nor is it unusual to select one for service upon such boards who is not a member of the United States Engineer Corps. Two of the Bixby board of 1907, composed of five members, did not belong to that corps. One was an attaché of the Coast and Geodetic Survey and the other a civil engineer taken from civil life. It should be noted, too, that the interests of the United States are safeguarded not less carefully than in the acts of 1902 and 1907, the present bill, among other things, authorizing the board to consider reports of former boards in which full consideration is given to anticipated expense to the United States, especially in connection with the withdrawal of water from Lake Michigan and the question of damages likely to accrue by the overflow of private property.

The proposed appropriation of $1,000,000 for this waterway is not made available in this bill. Indeed, the committee is informed by the Comptroller of the Treasury that until further future affirmative legislation by Congress it will neither be available nor will it be entered upon the books of the Treasury Department as a charge upon the Treasury. It is introduced at this time to indicate the committee's willingness to improve the Illinois River whenever Congress can, by suitable cooperation with the State of Illinois, make a proper improvement at a reasonable expense.

This provision is not considered by the Senate committee as in anywise committing the Government to the project.

MISSOURI RIVER—GENERAL IMPROVEMENT.

The length of navigable river from Fort Benton to mouth is 2,284.8 miles. Some portions of the river above the Great Falls are also navigable

The original condition of the river was, and to a great extent the present condition is, one of alternate pools and bars. The low-water depth over bars is about 3 feet and the width of the river at such places is from one-third to 1 mile. In the deep reaches the width is 800 to 1,500 feet and the low-water depth in such places is often over 12 feet. Generally speaking, the navigable low-water depth of unimproved river is 3 feet and of high water only 9 feet. The navigable depth does not increase as rapidly as the water height, since the bars rise with the stage of river. The river is also encumbered with snags, which, however, are getting fewer, due to constant snagging operations.

No project for the improvement of the river as a whole has been adopted.

Government work on the river in the matter of removal of snags began as early as 1838 and continued thereafter, under annual appropriations (for the most part made jointly for the Ohio, Mississippi, Missouri, and sometimes the Arkansas rivers), with occasional intermissions, for the next forty years. Prior to 1878 one or two small appropriations had been made for general improvement, but it was with the act of June 18 of the latter year that appropriations began on a large scale.

The work prior to 1884 was carried on under separate districts.

A project for the river from Sioux City to the mouth was adopted in 1884, the improvement to consist of rectification, revetment, and snagging. In 1890 the project was modified by systematic improvement of the first reach, from Jefferson City to the mouth.

From 1884 to 1890 the work on the entire river was under the Missouri River Commission. After 1890 that portion above and including Sioux City, Iowa, was under a separate district until 1902. Since the discontinuance of the Missouri River Commission the works on the entire river have been consolidated under one district.

The greater part of the work on the portion of the river below Sioux City has been done by the Missouri River Commission, reporting to the Chief of Engineers. The Commission was constituted by act of Congress of July 5, 1884, and was abolished by the river and harbor act of June 13, 1902.

On the portion of the river above Sioux City the work has been done under the immediate charge of officers of the Corps of Engineers, except during the period from 1884 to 1890, when it was in the charge of the Missouri River Commission. The effort of the commission in its work below Sioux City was to accomplish a continuous, progressive control of the river, contracting it where necessary, giving the channel proper direction, and securely holding it in place. Work in this direction was done in the vicinity of Kansas City and on the first reach of the river, which extends from near Jefferson City to the mouth. On 45 miles of this reach a continuous channel of not less than 6 feet in depth at low water was obtained on what was originally one of the worst parts of the river, in the vicinity of the mouth of the Osage. In addition to forming a channel, much new land was formed and much land protected from destruction by the river. The greater part of the funds appropriated for expenditure under the direction of the Commission was not applicable to the comprehensive plan of improvement adopted, and about one-third of it was diverted to work at separate localities.

On the upper portion of the river the work originally consisted mainly in improving the shoals and rapids on the so-called "Rocky River" from Fort Benton downstream for 150 miles. In recent years it has largely been limited to channel regulation and bank protection at the following points: Williston and Bismarck, N. Dak.; Pierre, Yankton, and Elk Point, S. Dak.; and Sioux City, Iowa. Two ice harbors have been established, one at Rockhaven, N. Dak., the other in the mouth of the Big Sioux River, just above Sioux City.

Works of channel regulation have also been built in the Long Pool, or the reach of the river from the crest of the Great Falls to Cascade, and a small amount of open-river work in the steeper stretch from Cascade to Stubbs Ferry.

In addition to the foregoing work, a fleet of snag boats has been in operation clearing the channel of snags and other obstructions on the

portion of the river where boats have been running. This work is considered to be directly beneficial to navigation.

The total of appropriations for the river, and of receipts from other sources, from the mouth to Sioux City, including snagging, beginning with the act of June 18, 1878, is $9,402,833.25.

The total of the appropriations and of receipts from other sources for improvements of the upper river, including snagging, beginning with the act of August 14, 1876, is $2,288,807.47.

The total of appropriations for improving Missouri River from mouth to Fort Benton, Mont., $555,000.

Grand total of all appropriations and receipts from other sources, $12,246,640.72.

Total expenditures on account of examinations, surveys, and contingencies, rivers and harbors, $1,031.65.

The total expenditures for all purposes have been $11,604,800.19.

The result of these expenditures has been to demonstrate the possibility of regulating the river in such manner as to make it navigable for a channel of commerce; that the cost of such regulation would be very great, and that no permanent good to navigation can be accomplished by appropriations for specific localities not so connected as to form part of the systematically improved reaches. The result of the expenditures at separated localities has been beneficial locally by protecting the banks and forming good navigable water fronts and incidentally preserving private property from the ravages of the river, but has given little, if any, encouragement to through navigation.

At the localities under improvement an effort has been made to maintain the existing and prevailing depth of channel. The least depth at mean low water over the shoalest part at the localities under improvement is not less than 6 feet. The usual variation of level of water is about 19 feet at Kansas City, 8 feet at Fort Benton, and 25 feet at St. Charles.

The maximum draft June 30, 1909, at mean low water from Kansas City to mouth is 4 feet, from Kansas City to Sioux City 3½, and from Sioux City to Fort Benton 3 feet. The head of navigation is Fort Benton, 2,285 miles above the mouth. Above this point rapids begin, which at Great Falls are a series of falls, the aggregate fall being 500 feet. Above Great Falls there is a navigable depth practically to Three Forks.

The effect of the improvement has been to equalize and keep down freight rates, the actual river rates being about 60 per cent of the railroad rates.

A condensed description of the works on the river executed under the supervision of the Missouri River Commission is given in the Commission's last annual report (Annual Report of the Chief of Engineers for 1902, Supplement).

A condensed description of the work above the Great Falls will be found in the Annual Report of the Chief of Engineers for 1899, pages 385–386, and in later annual reports; and of the work on the river between Fort Benton and Sioux City in the Annual Report of the Chief of Engineers for 1902, pages 382–385.

A complete survey of the river has also been made, in part by the Commission and in part by officers in charge of the districts on the upper portions of the river, and has been published in 83 maps, scale 1 inch to the mile.

The river formerly carried an active commerce, which at one time had been entirely diverted to other channels. This commerce now shows healthy signs of reviving.

Commerce has increased greatly on the lower river from Kansas City to the mouth during the season of 1908. Two boats regularly ran from Kansas City to St. Louis, each making a round trip every eight to ten days, and averaging a round-trip cargo of 600 tons. There is also a boat running from Jefferson City to St. Louis, and several boats plying between Osage River and St. Louis. A million-dollar boat line is now being organized at Kansas City for the purpose of placing a modern boat service upon the river from Kansas City to St. Louis, with proper wharfage and terminal facilities.

Increased commerce and use of the river is also observed in the upper river in the vicinity of Bismarck, N. Dak., and above to the mouth of Yellowstone River.

The character of upstream cargoes is merchandise and general supplies; downstream, grain and stock.

Amount of freight carried on the Missouri River from mouth to Sioux City, Iowa.

Calendar year—	Tons.	Calendar year—	Tons.
1897	391,029	1903	750,291
1898	319,793	1904	455,000
1899	263,114	1905	343,435
1900	277,306	1906	573,348
1901	569,666	1907	843,863
1902	410,527	1908	541,144

Amount of freight carried on the Missouri River above Sioux City, Iowa.

Calendar year—	Tons.	Calendar year—	Tons.
1887	13,961	1898	26,896
1888	12,895	1899	23,041
1889	16,723	1900	27,179
1890	14,072	1901	37,340
1891	14,211	1902	31,070
1892	17,292	1903	37,994
1893	19,481	1904	28,951
1894	37,936	1905	52,956
1895	21,264	1906	43,987
1896	10,368	1907	45,123
1897	17,105	1908	17,517

There is no existing project, except the use of such limited funds as have been appropriated since 1902 for purposes of snagging and emergency dike and revetment work. A new project and estimate of cost for improvement for 6-foot and 12-foot channel from Sioux City to Kansas City and Kansas City to mouth, called for by act of Congress March 2, 1907, was submitted April 30, 1908, and transmitted to Congress. (See H. Doc. 1120, 60th Cong., 2d sess.)

During the past year work has been in the main confined to repair work and snagging. New work was done as follows:

Extensive dike work was completed at Elwood, Kans. to prevent the river from leaving St. Joseph, Mo., and to protect banks and railroad bridge at Elwood. Half the cost of this work ($50,000) was contributed by the railroads concerned.

Dike construction was also done at Mokane, Mo., Atherton, Mo., and Elwood, Kans. At Williston, N. Dak., 3,075 feet of revetment was placed at a cost of $11,416.30 to the Government, the Great Northern Railway and the city of Williston furnishing the rock and brush, estimated at $25,000.

Extensive revetment work was also done by the Wabash Railway and by the Chicago and Northwestern Railway below Sioux City, and by the Chicago, Milwaukee and St. Paul Railroad Company above Sioux City.

A public hearing was held at Omaha, Nebr., on September 11, 1908, on the subject of harbor lines, approved by the Secretary of War June 5, 1909.

The act of March 3, 1909, for preservation and repair of river and harbor works, appropriated the following:

Missouri River, mouth to Fort Benton:	
Plant and boat yards	$155,000
Dikes and revetments	400,000

Preliminary examinations of certain localities are being made in compliance with the act of March 3, 1909, reports on which will be submitted to Congress at its next session.

By act of Congress, February 16, 1909, the Secretary of War was authorized to establish harbor lines on the Kansas River at Kansas City, Kans., and preparations for this work are now being made.

The amounts estimated as profitable expenditure for the fiscal year ending June 30, 1911, will be applied to snagging and repair and construction of dikes and revetments, being for maintenance of improvement as well as extension of benefits.

IMPROVING MISSOURI RIVER FROM STUBBS FERRY, MONTANA, TO SIOUX CITY, IOWA.

July 1, 1908, balance unexpended		$5,804.69
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$1,437.72	
For maintenance of improvement	1,959.58	
		3,397.30
July 1, 1909, balance unexpended		2,407.39

IMPROVING MISSOURI RIVER FROM MOUTH TO SIOUX CITY, IOWA.

July 1, 1908, balance unexpended	$17,955.95
Amount received from sale of maps	16.37
Amount received by deposit Isthmian Canal Commission	61.23
Amount received by overpayment of vouchers	24.63
	18,058.18
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	15,352.73
July 1, 1909, balance unexpended	2,705.45
July 1, 1909, outstanding liabilities	690.95
July 1, 1909, balance available	2,014.50

IMPROVING MISSOURI RIVER.

July 1, 1908, balance unexpended		$231,859.20
Received from services rendered by snag boats		399.49
Received from overpayment of vouchers		23.40
		232,282.09
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$77,976.65	
For maintenance of improvement	83,406.44	
		161,383.09
July 1, 1909, balance unexpended		$65,293.04
July 1, 1909, outstanding liabilities		13,453.36
July 1, 1909, balance available		41,839.68

EMERGENCIES IN RIVERS AND HARBORS (MISSOURI RIVER AT ELWOOD, KANS.).

July 1, 1908, balance unexpended	$18,970.09
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	9,968.81
July 1, 1909, balance unexpended	9,001.28

IMPROVING MISSOURI RIVER AT ELWOOD (CONTRIBUTIONS).

July 1, 1908, balance unexpended	$13,320.31
June 30, 1909, amount expended during fiscal year, for works of improvement	13,290.61
July 1, 1909, balance unexpended	29.70
July 1, 1909, outstanding liabilities	29.70

IMPROVING MISSOURI RIVER FROM MOUTH TO FORT BENTON, MONT., PRESERVATION AND MAINTENANCE OF RIVER AND HARBOR WORKS.

Amount allotted from appropriation by river and harbor act approved March 3, 1909	$555,000.00
June 30, 1909, amount expended during fiscal year, for works of improvement	2,525.47
July 1, 1909, balance unexpended	552,474.53
July 1, 1909, outstanding liabilities	26,413.02
July 1, 1909, balance available	526,061.51
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	350,000.00

MISSOURI RIVER AT ST. JOSEPH, MO.

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 824, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., March 16, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

The several questions propounded in the item of law ordering a survey of the Missouri River in the vicinity of Lake Contrary, are carefully considered by the district officer in the within report. The improvement contemplated is the extension of the work of bank revetment at St. Joseph along the river in front of Lake Contrary, to prevent a threatened diversion of the waters of the river into that lake.

The data furnished by the district officer in regard to the erosion of the bank indicate that it is only a question of time when the river will cut into Lake Contrary, the effect of which will be to divert the bed of the stream through this lake, and possibly others below, before it again joins the original course. Such a diversion of the waters of the river would jeopardize much valuable land, impair the usefulness of Lake Contrary as a health and pleasure resort, and would be detrimental to the future economical regulation of the river for the benefit of commerce and navigation. To permit it would to a great extent nullify the effect of the large expenditures already made for bank protection in that locality.

It appears from the statements contained within that there has recently been a revival of navigation on the Missouri River and that further efforts to develop water transportation are contemplated by the people of Kansas City, St. Joseph, Omaha, and Sioux City in the near future. The Board believes that it is advisable to complete the work outlined within in the vicinity of St. Joseph, at an estimated cost of $150,000, in order to preserve the regimen of the river and to avoid the greater expenditure which would

otherwise be required in the near future to make this section available to reliable navigation.

For the reasons briefly given above, the board concurs with the district officer and the division engineer in the opinion that the work of preventing the threatened diversion of the waters of the Missouri River into Lake Contrary would be of great benefit to the navigation which local interests hope to establish along the river, and to that extent can be considered as directly and necessarily required in the interest of prospective navigation. In view, however, of the fact that the immediate benefits of the improvement which are of substantial character, will accrue to interests other than those of commerce and navigation, it is believed that an equitable proportion of the expense of the work should be borne by the community, as suggested by the district officer, and the Board recommends that the expenditure of any appropriation made for this work be contingent upon an equal sum being furnished by local interests.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

For report on a more recent survey see Appendix.

The total commerce on the river between Sioux City and the mouth, for calendar year 1906, was 573,348 tons, the average for the last five years being approximately 506,000 tons.

GASCONADE RIVER, MISSOURI.

This river is similar to the Osage, consisting of alternate shoals and pools. The project for the improvement of this stream, adopted in 1880, consisted in the removal of snags and logs from the channel and of leaning timber from the banks of the river, where necessary, and the construction of wing dams and training walls to concentrate the flow of water upon the shoals to increase the depth over them.

From the nature of the project, which contemplates maintenance and relief from year to year and the removal of obstructions which are constantly forming anew, no definite time can be fixed for its completion. The improvement must therefore be continuous.

During the past season the boating channel was cleared of snags and wreck heaps and all overhanging trees were trimmed or felled.

The river and harbor act of March 3, 1909, appropriated $15,000 for the Gasconade River for maintenance of general open-river improvement.

The total of the appropriations and of receipts from other sources for the improvement of Gasconade River, beginning with the act of June 14, 1880, is $126,624.31.

The amount expended under the project to June 30, 1909, is $110,894.19.

The only influence the improvement has had upon freight rates is to afford shippers a regular means of transportation by boat.

It is proposed to use the amount that can be profitably expended in fiscal year ending June 30, 1911, in addition to the balance unexpended July 1, 1909, for works of improvement in continuing present project, which is indefinite, including plant to carry on work, and for maintenance of existing works.

The head of navigation is Arlington, Mo., and the number of navigable miles is 107. Prior to improvement light-draft boats were compelled to abandon their trips because of shoals; the same boats now go to the head of navigation without interference.

Amount of freight carried on the Gasconade River.

Calendar year—	Tons.	Calendar year—	Tons.
1895	47,544	1902	44,380
1896	46,294	1903	10,788
1897	30,515	1904	14,791
1898	30,981	1905	29,837
1899	24,259	1906	27,604
1900	51,580	1907	50,083
1901	19,460	1908	28,887

Report on preliminary examination and survey, made in compliance with act of March 2, 1907, was made February 24, 1908 (H. Doc. 829, 60th Cong., 1st sess.).

July 1, 1908, balance unexpended	$2,158.16
Amount allotted from appropriation by river and harbor act approved March 3, 1909	15,000.00
	17,158.16
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,428.04
July 1, 1909, balance unexpended	15,730.12
July 1, 1909, outstanding liabilities	1,156.64
July 1, 1909, balance available	14,573.48
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	20,000.00

The following report of the Board of Engineers on a recent survey of the Gasconade River, in which the Chief of Engineers concurs, is printed in House Document No. 829, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., March 13, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

It appeared from the report on preliminary examination of the Gasconade River that a more extensive improvement than that provided for by the existing project might be justified, and an estimate for a depth of 3 feet to Gascondy indicates that such an improvement will require an original outlay of $110,000, and $7,500 annually for maintenance. The district officer proposes to operate a plant consisting of a small combination dredge and snag boat, and to construct about 45,000 linear feet of regulation work.

A complete description of the physical characteristics of the stream and the commercial features which appear to warrant the improvement are given within, and in the reports to which reference is made. The commerce for 1906 amounted to 27,604 tons, of which 21,736 tons were railroad ties, while in 1907 it is reported that there was a commerce of 10,000 tons of general merchandise, not including lumber or tie rafting.

The work proposed by the district officer is essentially a continuation of the old project for open-river regulation. Without expressing certainty as to the exact results which will be attained, the Board is assured that a considerable amelioration of present conditions may reasonably be expected, and feels warranted in recommending appropriations to be expended along the lines proposed by the district officer.

The Board does not, however, feel that the total cost of the project should now be anticipated, as the work is to a large extent continuing in its nature, and in the course of years will gradually become more and more a matter of maintenance. For this reason the Board believes that the appropriation of reasonable annual sums sufficient for the construction and operation of the plant, and the progressive construction of the regulation works, will adequately meet the situation.

For the Board:

R. L. HOXIE,
Colonel, Corps of Engineers,
Senior Member Present.

OSAGE RIVER, MISSOURI.

A history of the work of improvement on this river, from the adoption of the original project in 1871 to the end of the fiscal year 1900, was published in the Annual Report of the Chief of Engineers for 1900, page 4944.

The original condition was one of alternate pools and shoals.

The work has been carried on under two projects—that of open-channel improvement, by the construction of cross and wing dams, in addition to dredging and removal of obstructions to navigation, such as snags, etc., and the construction of a lock and dam 7 miles above the mouth of the river.

The removal of obstructions under the first project contemplates maintenance. The obstructions will form anew, and while the cross and wing dams have a degree of permanency, they must receive frequent repair and extension to keep up their efficiency.

The amount expended by the General Government upon both projects up to June 30, 1909, is $800,939.82.

During the past year work on the general river has consisted in dredging, snagging, and repairs to longitudinal and cross dikes.

By act of March 2, 1907, the sum of $10,000 was appropriated for general improvement, and $68,000 was appropriated for continuing construction of Lock and Dam No. 1, with authority for contracts to the additional amount of $160,000, all of which has been appropriated for completion of the lock and dam.

The sundry civil act of March 4, 1909, appropriated $60,000 for the completion of the lock and dam.

The river and harbor act of March 3, 1909, appropriated $10,000 for the Osage River, for maintenance of general open-river improvement.

During the past year work has consisted in additional protection to the piers Nos. 6, 7, 8, and 9, and weirs 7, 8, 9, and 10. The gap between piers 1 and 6 is to be closed by a chanoine wicket dam, 36 feet of which has been completed.

During the past year work has been completed on the lock and dam as follows:

Protection of the foundation of the outer lock wall. Protection of the foundations of piers 7, 8, 9, and 10. The foundation of the dam throughout was reenforced by a deposit of 3 feet of concrete tamped around piling and up to floor for weirs.

Twelve air tanks installed in each of the four weirs in sections 7, 8, 9, and 10 and a 2-inch air pipe with flexible joint connected with each weir.

Thirty-six linear feet of the chanoine dam foundation completed.

Expenditures during the year:

Labor and services	$32,172.10
Material	16,527.75
Freight	3,301.01
	52,000.86

The work now in progress contemplates the completion of the chanoine dam foundation and installation of the wickets and eventual replacing of the wooden lock gates with steel ones.

The funds on hand and available will be applied to the completion of Lock and Dam No. 1, and to maintenance.

It is proposed to use the amount that can be profitably expended in fiscal year ending June 30, 1911, in addition to the balance unexpended July 1, 1909, for works of improvement, and for maintenance of general improvement, including snagging, dredging, and repairs to dikes.

The head of navigation is Warsaw, Mo., 172 miles above the mouth. Prior to improvement light-draft boats had to abandon their trips because of shoals; the same boats now ascend to the head of navigation without interference.

The improvement has only influenced freight rates by affording shippers a regular means of transportation by boat.

Previous reports.—Preliminary examinations August 22, 1884, and December 10, 1886. Reports of surveys December 28, 1870; February 11, 1875; February 13, 1879; April 21, 1881; January 9, 1890; November 9, 1900. Project adopted in 1871; snagging, dredging, and wing dams modified in 1890 by one lock and dam near mouth.

Report on preliminary examination and survey, made in compliance with act of March 2, 1907, was made January 21, 1908 (H. Doc. 960, 60th Cong., 1st sess.).

Amount of freight carried on the Osage River.

Calendar year—	Tons.	Calendar year—	Tons.
1895	76,706	1902	95,194
1896	72,393	1903	38,501
1897	71,247	1904	35,746
1898	84,286	1905	8,678
1899	76,702	1906	20,506
1900	96,144	1907	31,601
1901	72,339	1908	30,606

July 1, 1908, balance unexpended		$152,357.50
Amount allotted from appropriation by river and harbor act approved March 3, 1909		10,000.00
Amount appropriated by sundry civil act approved March 4, 1909		60,000.00
		222,357.50
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$3,362.05	
For maintenance of improvement	64,603.44	
		67,965.49
July 1, 1909, balance unexpended		154,392.01
July 1, 1909, outstanding liabilities		18,499.94
July 1, 1909, balance available		135,892.07
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		20,000.00

The following report of the Board of Engineers on a recent survey of Osage River is concurred in by the Chief of Engineers and printed in House Document No. 960, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., March 15, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

From the within report it appears that to December 3, 1907, the sum of $704,134.43 had been expended on the improvement of Osage River, of which $332,903.46 was for open-channel work similar in character to that now proposed, and $371,230.97 was for lock and dam construction. In an accompanying paper the district officer gives a list of the shoals requiring improvement to provide a depth of 3 feet to the

mouth of the Niangua River, and estimates the cost of necessary construction work at $278,500, the cost of a plant for dredging and snagging at $11,500, and the cost of its operation for a period of two years at $15,000, or a total outlay of $305,000. The subsequent cost of maintaining the improvement is estimated at $20,000 per year.

In reviewing the report of the district officer on the preliminary examination, the Board gave a brief statement of the commercial conditions which appeared to render this stream worthy of careful consideration, particular stress being laid upon the fact that the locality is destitute of suitable transportation facilities for marketing its products. From information contained in the within report it appears that the river in its present unsatisfactory condition is quite generally used for commercial purposes, even though navigation is difficult and attended with risks and inconvenience.

The completion of the lock and dam already provided for will carry slack-water navigation to a point about 27 miles above the mouth of the stream. In order that commensurate benefits may be derived from this work, the Board deems it desirable that suitable navigation facilities be available above, as the value to commerce of the slack-water improvement will largely depend upon the existence of water communication with the fertile areas of production along the upper river. The improvement proposed by the district officer is intended to provide a depth of 3 feet up to the Niangua River, which is distant 109 miles from the mouth and 82 miles from the head of the pool to be formed by the lock and dam. The project proposed is, in effect, a continuation, on more definite lines, of that already existing for improvement by open river regulation, and in so far as it is calculated to increase and extend the benefits derived from the expenditures already made the Board believes it to be justifiable. Experience on other rivers indicates that the results of work such as is proposed can not be predicted exactly, but that some considerable amelioration of existing conditions will be attained is to be expected. The certain method of improvement by a series of locks and dams would be too costly to be justified.

The Board concurs with the district officer and the division engineer in recommending the appropriation of the amounts asked, to be expended for the purposes stated.

For the Board:

R. L. HOXIE,
Colonel, Corps of Engineers,
Senior Member Present.

The commerce is carried by several boats of the usual western river type, and for the last ten years has averaged 65,000 tons. The principal commodities transported are hay, grain, live stock, lumber and its products, building material and gravel, barytes, and general merchandise.

As stated within, the section of country tributary to this stream is not accessible to any other means of transportation than by this river and by wagons over country roads, the distance to market or to points of shipment being so great as to practically prohibit the transportation of farm and timber products by the latter method. This river commerce, while moderate in extent, is of great importance to the community, owing to the lack of other transportation facilities, and is deemed worthy of consideration.

ENTRANCE TO HUMBOLDT HARBOR, CALIFORNIA.

The following report of the Board of Engineers, in which the Chief of Engineers concurs, is printed in House Document No. 950, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., May 11, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

The existing project for improving the entrance to Humboldt Harbor was adopted by Congress in 1892. It provided for parallel jetties, each about 8,000 feet in length, extending from the north and south spits to the crest of the ocean bar. The estimated cost of the work was $2,057,615. The work was commenced in 1889 and completed in 1899, at a cost of $2,040,203.35. An excellent channel 28 feet in depth developed

almost at once, and by 1903 this depth had increased to 31 feet. Since that time the outer ends of both jetties have been beaten down by the waves and the channel has deteriorated, and is now, as indicated on the map accompanying this report, about 22 feet in depth.

The within report describes quite fully the history of the work done and its present condition. The district officer is of opinion that the locality is worthy of further improvement and, after discussing methods, recommends the building up of the present north and south jetties to a height of 12 feet above low water, and the extension of the north jetty 2,000 feet, at a total estimated cost of $1,500,000. He states that some maintenance will be required, but that this can not be estimated until the effect of the jetties be determined.

It appears that the commerce of this port now slightly exceeds 700,000 tons annually, valued at about $15,000,000.

The Board has carefully examined all information available, including some that was submitted by a delegation of citizens of the Humboldt Harbor district to a committee of the Board at San Francisco on January 17, 1908, when in California in connection with other matters. It has arrived at the conclusion that the locality is worthy of further improvement by the General Government, and is in accord with the general plans suggested by the district officer. It believes, however, that the work proposed by him should be undertaken tentatively, as the construction of the jetties as originally carried out was very effective in securing a depth even beyond that required. These jetties have, as stated, been wrecked by storms at their outer ends and their efficiency impaired. The Board is of opinion that they should be fully restored and the effects noted before any further extension is made, and that the proposed extension of the north jetty should be undertaken if, in the light of experience, it should be found necessary. The cost of the proposed rebuilding of the jetties, as given by the district officer, is $1,037,400, and to this extent the Board believe the harbor is now worthy of improvement.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

The local engineer, in his report on preliminary examination, says:

The bay is a long narrow estuary, about 14 miles in length, and varies from one-half to 4 miles in width. Its longer axis is nearly parallel to the coast line, being separated therefrom by a narrow strip of sand one-eighth of a mile to 1 mile in width. This bay is the most important shipping port for lumber on the California coast. It is estimated that there are upward of 400,000 acres of redwood forest in the near vicinity still untouched. In addition to the lumber, the dairying and other agricultural interests are already of importance and are increasing year by year. It is the only harbor of any importance in California north of San Francisco. and one of few between San Francisco and the mouth of the Columbia River. It is located on a portion of the Pacific coast where the seas are of exceptional violence during storms. It has been reported by masters of steam vessels that no such heavy seas are encountered elsewhere in the world, unless perhaps south of the Cape of Good Hope and Cape Horn. Waves have been seen to break in 8 to 10 fathoms depth. It was originally believed that no jetties or other such construction for harbor improvement extending into the open sea in this locality could possibly withstand the forces brought to bear by the waves during storms, so that the improvement of the entrance to this bay was undertaken at first with many misgivings. The principal town in the harbor is Eureka, which had a population of 7,327 in 1900. The population at present is probably over 12,000.

Report on a recent survey of South Bay channel, Humboldt Harbor, is printed in House Document No. 204, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 2, 1909.

SIR: I have the honor to submit herewith, for transmission to Congress, reports of May 6 and July 30, 1909, by Lieut. Col. John Biddle, Corps of Engineers, on preliminary examination, with estimate of cost of improvement, of South Bay channel, Humboldt Harbor, California, with a view to the removal of obstructions to navigation to the wharf at Fields Landing, as authorized by the river and harbor act of March 3, 1909.

This landing is in the southern part of Humboldt Bay, and there is a good channel to it of 18 feet depth except over two shoals, where the minimum depth is 15 feet.

The cost of securing a channel 200 feet wide and 18 feet deep at mean low water through these shoals is estimated at about $10,000, with a small amount for maintenance after completion.

I concur in the opinion of the district officer, who is also division engineer, and the Board of Engineers for Rivers and Harbors, that this locality is worthy of the improvement proposed.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

The commerce is almost exclusively lumber. It averages 150,000 tons a year and will probably increase, as a new mill is under construction. It is hampered and delayed and rendered more costly by these shoals, as the type of boats used draw about 21 feet loaded.

OAKLAND HARBOR, CALIFORNIA.

The original condition of San Antonio estuary was as follows: It was a tidal arm of the Bay of San Francisco, with a tidal prism of 156,000,000 cubic feet. This filled and emptied itself with each coming tide. The tidal flow was sufficient to maintain a natural channel depth over the bar, off the mouth, of 2 feet at low tide. Within the estuary proper, where the bends are pronounced, mid-channel depths of 20 to 23 feet at low water and widths of 500 feet were found. Vessels drawing 5 to 8 feet could enter at high tide. The commerce in 1874 aggregated 154,300 tons.

The original project was submitted in 1874 in compliance with an act of Congress. The report, with project and estimate of cost, is printed in the Annual Report of the Chief of Engineers for 1874, page 378. This project called for (*a*) two mid-tide training walls at the entrance, (*b*) a tidal canal for flushing purposes about 1½ miles in length to connect with tide water in San Leandro Bay, (*c*) a dam at the entrance to San Leandro Bay, and (*d*) dredging a tidal basin and then a channel to have a depth of 20 feet from the basin to San Francisco Bay. The estimated cost of the work was in round numbers $1,815,000.

This was approved by Congress, and during the progress of the work slight modifications were made from time to time. These consisted of raising the training walls to full high-tide level; of increasing the width of the tidal canal to 400 feet; of building three steel bridges across the tidal canal; and of diverting the silt-laden storm waters of Sausal Creek from the tidal canal by means of a separate channel into San Leandro Bay.

The present project was adopted before this project was completed. Up to and including 1900, $2,450,600 had been expended on the original project.

In the river and harbor act of 1900 Congress provided for an examination of Oakland Harbor with a view to its improvement west of the tidal canal to meet the needs of present and prospective commerce. Three alternative plans and estimates for channel enlargement were submitted, estimated to cost, respectively, $646,293, $1,687,818, and $968,203. This report, with estimates, is printed in the Annual Report of the Chief of Engineers for 1901, pages 3448–3449.

On June 13, 1902, Congress appropriated $100,000 and authorized continuing contracts for $150,000 additional for the work, but failed

to specify to which of the above projects the funds were to be applied. Contract was made to the extent of the money available and authorized for dredging work which was common to all of the above projects. By act of March 3, 1905, Congress specifically named project No. 3, estimated to cost $968,203, appropriated $100,000, and authorized contracts for $250,000 additional for continuing the improvement with a view to obtaining a channel 300 feet wide and 25 feet deep from San Francisco Bay to Fallon street, Oakland.

Project No. 3 calls for a channel from San Francisco Bay, 500 feet wide and 25 feet deep at low water, to Chestnut street, Oakland; thence 300 feet wide and 25 feet deep at low water to Fallon street; thence 300 feet wide and 17 feet deep to tidal basin; thence 300 feet wide and 12 feet deep around the tidal basin, and extension of south jetty.

In the act of March 2, 1907, Congress provided for project No. 3, as recommended by the Board of Engineers for Rivers and Harbors in report of January 11, 1907, printed in River and Harbor Committee Document No. 9, Fifty-ninth Congress, second session, but the act extended the provisions of the project as follows:

Extension of south jetty 500 feet, widening to 500 feet the channel 25 feet deep from San Francisco Bay to Fallon street, deepening to 25 feet the channel 300 feet wide from Fallon street to the tidal basin, deepening to 17 feet the channel 300 feet wide around the north side of the tidal basin to the tidal canal, and from the tidal canal along the Alameda shore to Tenth avenue. The two preceding paragraphs cover the final project. The estimate of cost is $1,468,203.

The work is in progress under the continuing-contract system. The full appropriation under contract authorization has been made. In order to complete the improvement directed by Congress, an additional amount of $500,000 is estimated.

On June 30, 1909, at mean lower low-tide level, a channel 300 feet wide and 25 feet deep has been made for a length of 25,000 feet easterly from deep water in San Francisco Bay to the tidal basin at Tenth avenue. From the bay to Chestnut street this channel has a width of 400 feet with a depth of 20 feet in the additional 100 feet width, and from Chestnut to Castro streets and from Harrison to Fallon streets the channel has a width of 400 feet with 25 feet depth. In the tidal basin there is a partly completed channel 300 feet wide, 17 feet deep on the north side from Tenth avenue to Fifteenth avenue, a distance of 3,200 feet, the balance to the canal being 300 feet wide and 6 feet deep. On the Alameda side there is a partly completed channel 300 feet wide, 17 feet deep from Tenth avenue to Willow street, a distance of 5,300 feet, and the balance to the canal 300 feet wide and 6 feet deep. The range of the tides is 4.5 to 5.5 feet. The navigable portion of the channel is about 32,000 feet in length. Light-draft vessels can go a half mile farther east. The amount spent on the existing project is $702,006.86. The project is about half completed.

The money thus far spent has been practically all for extensions in channel widths and depths for the benefit of commerce. There has been spent for the maintenance of bridges since the adoption of present project $4,747.79. The sum of $5 has been received during the year from the sale of an old typewriter. High Street Bridge was destroyed by fire on May 21, 1909. Repairs will be undertaken early in the coming year.

It is difficult to estimate what increase of commerce is likely to result from an increased depth and width of channel in Oakland Harbor. At present about 64 per cent of the total tonnage of Oakland Harbor is overland freight transferred across the bay on ferryboats, which, when loaded with cars, draw only about 8 feet of water. If improvement be continued, it will permit the deeper draft vessels carrying to the city of Oakland coal, wood, coke, oil, hay, grain, flour, lumber, building material, and sundries, which in 1908 amounted to 3,601,871 tons, valued at $142,808,120, and also should induce a large increase in manufacturing industries on the shores of this harbor.

It is believed that the improvement has had no material effect on freight rates. Passenger rates are 5 cents per trip, while all other ferries charge 10 cents per trip.

It is proposed to spend the funds available for dredging in accordance with contract for extension of benefits.

It is proposed to spend the funds estimated in continuing work in accordance with project directed by Congress. This will be for the extension of benefits. The amount asked for as maintenance it is proposed to use for repairs of bridges and for dredging small shoals that may develop, particularly at the mouth of the channel. The original project did not provide for maintenance. It has developed that the bridges have to be maintained and that shoals develop and must be dredged. This is in part due to the fact that while the tidal prism remains the same as in the project of 1874, the size of the channel is largely increased in the present project.

In connection with this improvement a tidal canal connecting San Leandro Bay with Oakland channel was excavated by the United States. This canal was intended for flushing purposes only, and no provision was made for operation of bridges over it which are owned by the United States and are provided with draws. A demand appears to have arisen for the opening of the canal to navigation, as explained in the district officer's report, but the bridges form an impediment to such use, and he recommends that they be turned over to the local authorities, who have signified their willingness to accept and operate them.

July 1, 1908, balance unexpended		$284,454.37
Amount allotted from appropriation by river and harbor act approved March 3, 1909		15,000.00
Amount appropriated by sundry civil act approved March 4, 1909		256,000.00
Amount received by reimbursement from Isthmian Canal Commission		14.21
Amount received from sale of old typewriter		5.00
		555,473.58
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$273,472.73	
For maintenance of improvement	785.50	
		274,258.23
July 1, 1909, balance unexpended		281,215.35
July 1, 1909, outstanding liabilities		28,416.27
July 1, 1909, balance available		252,799.08
July 1, 1909, amount covered by uncompleted contracts		187,548.10
Amount (estimated) required for completion of existing project		500,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		315,000.00

Report on a recent survey of Oakland Harbor is printed in House Document No. 647, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, February 2, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated July 23 and December 10, 1909, by Lieut. Col. John Biddle, Corps of Engineers, on preliminary examination and survey, respectively, called for by the river and harbor act of March 3, 1909, of Oakland Harbor, California, with a view to obtaining a suitable depth and width and sufficient anchorage room.

The existing project for improvement of Oakland Harbor provides for extending the south jetty 500 feet, securing a channel 500 feet wide and 25 feet deep from San Francisco Bay to Fallon street, thence 300 feet wide and 25 feet deep to the tidal basin, and thence 300 feet wide and 17 feet deep around the tidal basin. Work on this project is now well under way.

The district officer presents several plans for further improvement, the one recommended by him contemplating a channel 30 feet deep and 500 feet wide from the bay to the tidal basin, 25 feet deep and 300 feet wide around the basin, and 18 feet deep along the tidal canal, at an estimated cost of $1,100,000 and $25,000 annually for maintenance. Of this work, he recommends that the 30-foot channel as far as the drawbridges be first constructed, at an estimated cost of approximately $600,000, the remainder to be undertaken gradually, as commerce requires. He states that there is ample and safe anchorage in San Francisco Bay, and that no dredging of further anchorage ground is necessary.

I concur with the district officer, who is also division engineer, and the Board of Engineers for Rivers and Harbors that this locality is worthy of further improvement by the General Government under this progressive project.

Attention is particularly invited to the statement of the district officer that his estimates of costs are based upon the prices for which the work can be done by a government dredge. If provision is not made for the construction of such a dredge and accessories for use in prosecuting the work, the cost will probably exceed the amounts above stated; while if a suitable dredging plant is provided, it is possible that the work can be completed for a smaller amount than that estimated by the district officer. A suitable plant can be provided for $200,000.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

SAN DIEGO HARBOR, CALIFORNIA.

The following is extracted from House Document No. 96, Sixtieth Congress, first session, being the report of the Board of Engineers on a recent survey of this harbor:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., May 11, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

The district officer has made a careful study of the improvement of the entrance to San Diego Harbor by means of jetty extension and by dredging, and his conclusions are that the improvement by dredging is the most desirable. The work proposed by him involves a cut 600 feet in width through the outer bar, and a cut through the "middle ground" just inside the harbor with a minimum width of 400 feet, flaring somewhat at the northerly end of the cut so as to make a more convenient entrance to a projected coaling station, a short distance above, both cuts to be dredged to a depth of 30 feet.

The district officer estimates that the improvement by jetties will cost about $1,000,000, and by dredging without additional jetties, $100,000 for the outer bar and $25,000 for the cut through the "middle ground." In a subsequent report looking toward the provision of anchorage and harbor facilities to meet the requirements of the Navy Department, he estimates that the removal of the entire "middle ground" west of the cut will cost $134,250. This plan was submitted to the Navy Department for an expression of its views in regard to the adequacy of the improvement proposed in so

far as it affected that Department, and from its reply it appears that a very wide cut through the "middle ground," making a broad channel to and from the coaling station, would provide better facilities than the removal of the "middle ground" west of the cut originally proposed. The line marked "5-fathom contour line" on the accompanying print was laid down by the Navy Department, which states that the amount to be dredged between this line and the cut proposed by the district officer is practically the same as that required for the removal of the "middle ground" west of the cut, and that the dredging of this area will better meet the requirements of that Department.

The importance of this harbor has been increasing for a number of years and has been recently accentuated by its selection for a coaling station and rendezvous for naval vessels. It is believed that its further growth as a commercial port in connection with its use as a naval station is sufficiently assured to warrant the United States in undertaking its further improvement. So far as the commerce of the port is concerned, it is believed that the improvement proposed by the district officer, namely, a cut through the outer bar 600 feet wide and a cut through the "middle ground" with a minimum width of 400 feet, at an estimated cost of $125,000, would be sufficient to meet all reasonable demands for at least a number of years to come, and the Board recommends the improvement to this extent, at least. If, however, it is desired to meet the requirements of the Navy Department by providing anchorage and easy access to and from its coaling station, it would appear advisable to enlarge the cut through the "middle ground" by dredging to a depth of 30 feet the entire area between the line on the west marked "proposed dredging line, account of naval coaling depot," and the line on the east marked "5-fathom contour line." In this case the total cost of the improvement is estimated at $259,250.

The commerce of this harbor was 250,866 tons for the calendar year 1908, a decrease of 3 per cent from that of the previous year. It consists principally of lumber, general merchandise, and ore shipped. The value of this commerce is estimated to be $11,191,460.

The coastwise trade is carried in vessels drawing from 12 to 20 feet of water, and is benefited but little by the improvement of the harbor. The American-Hawaiian steamers, of 8,000 to 10,000 tonnage each, enter this port once a month. These vessels draw about 26 feet of water and carry 1,000 to 2,000 tons of freight per month for San Diego. Freight for San Diego carried by the Panama steamers is delivered by coastwise steamers from San Francisco. The American-Hawaiian steamers and the Panama steamers have a rate from the Atlantic ports to San Diego averaging about 30 per cent cheaper than railroad rates. Foreign cements are received in this port in sailing vessels drawing 22 and 23 feet of water.

ROCKS IN SAN FRANCISCO HARBOR, CALIFORNIA.

Report on a recent survey is printed in House Document No. 1119, Sixtieth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 3, 1908.

SIR: I have the honor to submit herewith for transmission to Congress reports of June 18, 1907 (with outline map), and September 22, 1908, by Lieut. Col. John Biddle, Corps of Engineers, on preliminary examination and survey, respectively, authorized by the river and harbor act approved March 2, 1907, of San Francisco Harbor, California "with a view to the removal of Mission Bay rocks, Packard rock, Whiting rock, Fifteenfoot rock, Invincible rocks, Noonday rocks, and Anita rock. Also Centissima and Sears rock and two other rocks near Mail Dock in Bonita Channel."

At the time the examination was made it appeared that the removal of Whiting, Invincible, Centissima, and Sears rocks, and of two rocks near the Mail Dock, San Francisco Harbor, would be justified by the commercial interests involved, provided the same could be effected at reasonable cost, and surveys were ordered in accordance

with the law. Mission Bay, Packard, Fifteenfoot, Noonday, and Anita rocks were regarded as not worthy of being removed at the present time, and surveys thereof were not ordered.

As a result of the survey Lieutenant-Colonel Biddle recommends the removal of Centissima rock and the two rocks near the Mail Dock (now reported as being also known as Rincon Reef rocks), at an estimated cost of $110,000 and $60,000, respectively, or $170,000 in all. From the facts and for the reasons given in his report of September 22, 1908, the removal of Sears, Whiting, and Invincible rocks is not now recommended by him.

The views and recommendations of the district officer are concurred in by the Board of Engineers for Rivers and Harbors and by the Chief of Engineers.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

Commerce.—The commerce of San Francisco Bay which would be affected by the removal of the rocks outside the entrance of the bay, and to a certain extent by the removal of the rocks near the Mail dock, is, from the records of the custom-house as furnished by Mr. W. B. Hamilton, special deputy collector of the port, a total for the year 1906 of 822 entrances, aggregating 1,789,408 tons, and 1,198 clearances, aggregating 1,999,437 tons. This does not include many coasting vessels, of which no record is kept at the custom-house, as such vessels are not required to clear or enter; nor does it include the many government vessels, both United States and foreign, which visit this port annually. The commerce that would be affected by the removal of Whiting and Invincible rocks, off Point San Pablo, includes all that of the Sacramento, San Joaquin, Mokelumne, and Napa rivers, and Petaluma Creek, which amounts to 1,200,000 tons annually; and, in addition, the commerce to points on Carquinez Straits, the exact amount of which is not known, but which is large, including seagoing steamers and vessels transporting oil, grain, and lumber. In addition, all vessels going to Mare Island Navy-Yard will be affected.

Whiting rock and Invincible rock are situated off Point San Pablo. The former is of comparatively small size, but it is estimated that the latter has a cubical content probably in excess of 30,000 yards. Both of these rocks are now marked by suitable buoys, but are near the sailing line of vessels using San Pablo Bay.

Centissima and Sears rocks lie in the Bonita channel, entirely outside the entrance to San Francisco Bay. This channel is one frequently used in bad weather, when the bar is too rough to cross, but the obstructions named reduce the navigable width of the channelway to about one-fourth of a mile.

Near the Pacific Mail dock, in San Francisco Harbor, are two small rocks having cubical contents of about 4,000 yards above a plane of 30 feet below mean lower low water. These rocks lie directly off the city front of San Francisco, where they interfere with vessels which are constantly passing.

BREAKWATER AT SAN PEDRO BAY, CALIFORNIA.

The following report of the Board of Engineers is concurred in by the Chief of Engineers and printed in House Document No. 969, Sixtieth Congress, first session.

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., February 17, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

In addition to the information furnished by the district officer in his report on preliminary examination of "San Pedro Breakwaters, with a view to determining whether the same should be extended to the shore," and the within report on an estimate of cost of the work involved, the Board, through a committee of its members, secured valuable information by a personal inspection of the locality and a public hearing held at San Pedro on January 14, 1908, which was attended by a large number of citizens of San Pedro, Wilmington, Los Angeles, Long Beach, and other adjacent communities.

The committee found a very strong sentiment in favor of closing the gap at the shore end of the breakwater. It was claimed that the harbor was rendered insecure for the anchorage of small craft, due to waves of considerable size entering through the gap during westerly and southerly storms, and also that the waves were a serious obstacle to an extensive projected commercial development along the shore between the entrance to the inner harbor and a point on the main shore about in prolongation of the westerly arm of the breakwater. This area would be completely protected by the breakwater if extended to the shore.

The district officer and the division engineer unite in recommending the improvement contemplated in the act. With reference to the estimate of cost, the district officer states that if the work is done in the near future, before the completion of the present contract for the construction of the breakwater, the work can probably be done for $178,000, but that if the work is not undertaken before the completion of the present contract, it may cost as high as $284,800. As it does not seem likely to the Board that provision for any new work on the breakwater will be made by Congress prior to the completion of the existing contract, it believes that the larger figure will have to be taken as the probable cost of the work.

The benefits to result from the closing of this gap can not be estimated on the basis of the amount of tonnage to be affected, for it is practically impossible to separate the tonnage of the outer harbor from that of the inner. It can reasonably be assumed, however, that practically all of it is benefited, indirectly at least, by any improvement tending toward the development of either the outer or the inner harbor. The total amount of commerce reported at the present time which would probably be influenced by the improvement, being that of the outer and inner harbor, is slightly in excess of 1,000,000 tons, valued at about $20,000,000. That benefit to small vessels seeking anchorage in the outer harbor, and to the prospective commercial development on the shore, will result can not be doubted, and the Board agrees with the district officer and the division engineer in believing that these benefits are sufficient to justify the cost of extending the breakwater to the shore. From the experience had in this harbor since the construction of the breakwater began, and from statements made to the Board, it appears that no serious objection to the work contemplated can be advanced. It is stated that the effect of the opening is to cause rather than to prevent the deposition of material behind the breakwater.

In view of the foregoing, the Board concurs with the district officer and the division engineer in recommending the adoption of the project proposed by the district officer.

WILMINGTON HARBOR, CALIFORNIA.

Report on a recent survey is printed in House Document No. 1114, Sixtieth Congress, second session. Following is the letter of the Chief of Engineers submitting the same.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 4, 1908.

SIR: I have the honor to submit herewith for transmission to Congress reports of April 24, 1907, and December 17, 1907, by Capt. Amos A. Fries, Corps of Engineers, on preliminary examination and survey, respectively, provided for by the river and harbor act approved March 2, 1907, of Wilmington Harbor, California, with a view to obtaining an increased depth.

Wilmington Harbor (also known as the inner harbor of San Pedro) has been under improvement by the United States since 1871, the project adopted by the river and harbor act approved June 13, 1902, under which work is being carried on at present, having for its object the securing of a channel 20 feet deep and 400 feet wide from the outer harbor to the foot of the wharves and thence a depth of 24 feet to and including a turning basin 1,600 feet in diameter between the upper end of the wharves and the lower end of Mormon Island. It is expected that this project will be completed during the year 1909.

In his survey report of December 17, 1907, Captain Fries submits estimates for securing depths of 27 and 30 feet at mean low water within the limits of the present project. He is strongly in favor of dredging this entire area to the depth of 30 feet, for which estimates of cost are submitted as follows: If done by contract, $540,000; if done with plant owned by the Government, $530,000, including cost of new dredge, or $420,000 if done with the dredge already belonging to this improvement. He recommends the plan calling for an expenditure of $530,000, including the purchase or construction of a new dredge.

In forwarding the survey report to this office the division engineer, Lieut. Col. John Biddle, Corps of Engineers, recommends the proposed increase in project depth to 30 feet as being desirable, but fails to specify whether by contract or otherwise.

These reports were duly referred, as required by law, for review and recommendation by the Board of Engineers for Rivers and Harbors, and attention is respectfully invited to the Board's final report, dated April 4, 1908, also herewith. In conclusion the Board recommends that the existing project for Wilmington Harbor be modified so as to provide a depth of 30 feet at an estimated cost of $420,000, the work to be done with existing plant owned by the United States.

I concur in the views of the Board. While a second dredge would be very desirable, some time would necessarily elapse before it could be made available, and it is believed that a 30-foot depth of practicable width where most needed could be obtained with the present dredge by the time the new dredge, if authorized, would be ready for use.

Following is an extract from the report of the Board of Engineers:

With a view to securing all possible information in connection with this important improvement, the Board, through a committee of its members, made a personal inspection of the harbor on January 14, 1908, and held a public hearing at San Pedro, which was attended by a large number of interested persons, many of whom presented orally or in writing, facts and arguments bearing upon the questions involved.

The commerce of this port now exceeds 1,000,000 tons annually, and indications point strongly to a continued growth in the future. Up to recent years traffic has been restricted to coastwise vessels of moderate size, but deep-draft vessels are now seeking the port and there is reason to believe that if increased facilities are provided immediate advantage will be taken of them not only by coastwise vessels of greater draft than are now able to enter the port, but probably by vessels engaged in foreign trade.

Although the law directed that this investigation should be undertaken "with a view to obtaining an increased depth," the accompanying reports treat more or less at length of a proposition to extend the improvement to the inner harbor of Wilmington beyond the limits of the present project. Under a strict interpretation of the law these additional matters should have no place in these reports; but in view of the general local interest in the subject and the discussion that has already been given the matter at public hearings, etc., I am constrained to permit the reports to stand as submitted, with the understanding that no work other than that of dredging to a depth of 30 feet within the limits of the present project is recommended by the department in this connection.

Repeated reference is made in the reports herewith to the necessity for the establishment of harbor lines in the inner harbor at Wilmington. Such lines were established by the Secretary of War July 29, 1908, under authority of joint resolution of Congress, approved March 26, 1908.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

After mature consideration the Board has arrived at the conclusion that the depth to be provided under the existing project is inadequate to meet the demands of commerce, and that this depth should be increased to 30 feet. This additional improvement, in connection with the facilities to be provided in the outer harbor under the shelter of the breakwater, will afford an opportunity for a considerable commercial expansion, and will, in the opinion of the Board, be sufficient to meet all reasonable demands for deep-draft navigation for at least a number of years to come.

The Wilmington lagoon above the turning basin is an extensive area of tidal flats overflowed very generally at high water and largely bare at low water. Through these

flats in various directions are small, indefinite, and uncertain channels which have but little navigable capacity and do not lend themselves in any important degree to the uses of commerce. The establishment of commercial facilities in this area must be preceded by the dredging of channels and the reclamation of adjacent areas for use as terminals, etc. It is understood that the local interests are desirous of proceeding with the development of this locality for commercial uses, and that the inauguration of the work only awaits the removal of existing uncertainties as to areas to be designated and set apart for channel and terminal facilities, respectively.

MOKELUMNE RIVER, CALIFORNIA.

The navigable portion of this river is a tidal stream emptying into the San Joaquin River. It is navigable for 20 miles above its mouth, and with its branches or forks about 14 miles additional. It also connects with other navigable sloughs forming the delta of the San Joaquin and Sacramento rivers. Regular lines of steamboats go to New Hope Landing, about 14 miles above the mouth. Motor boats go above regularly, and steamboats go occasionally to the New Hope-Galt Bridge to bring in supplies and take out the crops. Six feet at low tide is found as far as Snodgrass Slough, 13 miles above the mouth. Above that are found shoals 3 to 4 feet in depth. The tidal range is about 3 feet. The difficulties of navigation have been mostly due to snags and overhanging trees.

The first project was made in 1881 for their removal at an estimated cost of $8,250. (See Annual Report, Chief of Engineers, 1882, p. 2637.) The project was enlarged in 1891 to include, beyond snagging, the closing of a small canal and removing, by dredging, a tongue of land opposite New Hope Landing. The estimated cost to put the river in navigable condition was $7,100. (See Annual Report, Chief of Engineers, 1891, p. 3135.) Appropriations were made in 1892 and 1894, amounting to $5,000, and the work of closing canal and removing point was completed. No appropriations were made between 1894 and 1905. Since then the amounts appropriated have been used for maintenance by snagging, dredging small bars, and cutting off sharp points. The balance now available will be applied, as above, for maintenance.

The total amount expended on this improvement to June 30, 1909, was $20,392.24.

The improvement has resulted in a reduction of freight rates. There have been no records kept of the tonnage on this river. It is estimated by various parties as between 50,000 and 100,000 tons. This is largely carried by scow schooners on irregular trips. The steamboat company operating on the river gives the amount of tonnage carried by its steamers as 25,284 tons, at an estimated value of $1,800,000. The imports are lumber, coal, live stock, and merchandise; the exports, grain, flour, fruit, vegetables, and other produce.

The amount estimated for the fiscal year 1911 will be used on dredging bars and snagging, for maintenance of improvement.

July 1, 1908, balance unexpended	$2,625.76
June 30, 1909, amount expended during fiscal year for maintenance of improvement	18.00
July 1, 1909, balance unexpended	2,607.76
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	2,000.00

PETALUMA CREEK AND NAPA RIVER, CALIFORNIA.

(*a*) *Petaluma Creek.*—This creek has a length of 16 miles and is an estuary of San Pablo Bay. Its head of navigation is the town of Petaluma, a place of about 4,000 inhabitants.

Before improvement it was very crooked, dry in many places at low tide, and could be navigated only at medium or high tide stages.

Project was made in 1880 for straightening the creek by making cut-offs and dredging so as to obtain a channel 50 feet wide and 3 feet deep at low water, estimated to cost $25,868. (See Annual Report of the Chief of Engineers for 1880, p. 2243.) In 1892 the project was extended to dredge the channel as deep as funds would permit. Work has been done under the project as funds were appropriated. The project was enlarged by the river and harbor act of March 2, 1907 (see H. Doc. No. 387, 59th Cong., 1st sess.), to provide for dredging a channel 6 feet deep at low tide and 50 feet bottom width from the mouth of the creek to McNears Canal, and 4 feet deep and 50 feet wide thence to the head of navigation at Petaluma. The additional cost of this work is estimated at $15,239, which was appropriated March 2, 1907.

Under contract completed October 21, 1908, a channel 50 feet wide and 6 feet deep, mean low water, was dredged up to McNears Canal, and 50 feet wide and 4 feet deep to head of navigation at Petaluma.

In March, 1909, it was found that, due to heavy floods, the channel above McNears Canal had shoaled its entire length, and for 1½ miles below the canal had shoaled in several places. With funds available an emergency contract was entered into April 1, 1909, and with funds subsequently available a second emergency contract was made May 24, 1909. Under these contracts, which were almost completed June 30, a channel 3 to 4 feet deep was dredged from the lower part of Petaluma City to within 2,000 feet of the head of navigation. It is proposed to continue dredging so as to obtain dimensions of channel in accordance with approved project in the near future.

In October, 1908, complaint was made of shoaling in San Pablo Bay across the flats at the entrance to Petaluma Creek. An examination was made and a survey found necessary to determine the extent of shoaling. An examination was accordingly made over an area of 2 miles wide and 5 miles long, and the examination showed that the original channel across the flats was practically obliterated, so that there was an available depth in the shoalest part of only about 2½ feet at the mean of lower low water. There is no project to cover improvement at this place, which, being in San Pablo Bay and exposed to the winds and waves, will be very costly.

The maximum draft that can be carried June 30, 1909, at mean low water over the shoalest part is 3 to 4 feet, except the upper 2,000 feet, where the creek is about dry at low water. Navigation is carried on only at higher stages of the tide. The usual tidal range is about 8 feet.

The amounts available and estimated for the fiscal year 1911 will be used for dredging and snagging, and are for maintenance.

The total amount expended to June 30, 1909, is $85,593.61.

The amount spent on the existing project up to June 30, 1909, is $17,785.09. Of this amount, $475 has been spent for maintenance of improvement. Nothing has been derived from sales or other sources.

A new transportation line, the Petaluma Transportation Company, has been established during the year. This company operates the steamer *Resolute* between Petaluma and San Francisco.

The commerce on Petaluma Creek is large. The statistics have been carefully collected by the Chamber of Commerce of Petaluma. There are 2 steamers running regularly the whole year, and 1 for about five months, besides over 60 schooners making trips more or less regularly as they find freight. The exports and imports by the river are given at 155,000 tons, valued at over $8,000,000. Commerce by railroad is given as 100,000 tons, valued at $4,500,000. It is considered that water transportation has aided largely in the development and prosperity of the contiguous country and has materially affected freight rates.

(*b*) *Napa River.*—Before improvement this river had a low-water depth of 5 feet for about 12 miles above the Mare Island Navy-Yard and about 1 foot depth on the crest of the bars in the next 4 miles of its length to the head of navigation in front of the town of Napa. The ordinary range of tides is about 5 feet. Spring tides reach a height of 7 feet.

Project for the improvement was made in 1888, which contemplated the dredging of the bars and cutting off projecting points of land so as to obtain a channel 75 feet wide with a least depth of 4 feet at low tide and to remove logs, snags, and other obstructions. The estimated cost was $27,600. Examinations were again ordered by Congress and made in 1896, 1899, and 1902. Report on the latter is printed in the Annual Report of the Chief of Engineers for 1904, page 3427.

Navigation on the river is possible and profitable only at medium and high stages of the tide. The existing project and old project are identical.

Work was begun in accordance with the project in 1889 and has progressed since whenever funds became available.

The total amount expended on this improvement to June 30, 1909, is $37,177.64. Of this amount, $9,577.64 has been spent for maintenance of improvement. Nothing has been derived from sales or other sources.

The only work done during the fiscal year was removing a large snag from the draw of the bridge at Napa, and also removing some old piles and stumps from the river. The total amount spent during the fiscal year was $123.55.

The heavy rains and floods of the past winter have caused considerable shoaling in the channel, so that there is now not over 1 foot of water at low water over some of the bars. The exact condition of the channel is not known and a survey will be necessary to determine the amount of shoaling. Dredging will be necessary in this channel within the next few months.

The maximum draft that can be carried June 30, 1909, at mean low water over the shoalest part is 1 foot.

The amounts available and estimated for the fiscal year 1911 will be used for dredging and snagging, and are for maintenance.

Freight rates are reasonable, due to the maintenance of navigation.

The commerce of Napa River during the year 1908 amounted to 207,880 tons, the value not being given. This commerce was all carried by th steamers and schooners of one transportation company.

CONSOLIDATED.

July 1, 1908, balance unexpended		$18,671.61
Amount alloted from appropriation by river and harbor act approved March 3, 1909		15,000.00
		33,671.61
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$13,675.95	
For maintenance of improvement	598.55	
		14,274.50
July 1, 1909, balance unexpended		19,397.11
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		20,000.00

SACRAMENTO AND FEATHER RIVERS, CALIFORNIA.

The first appropriation by Congress was "for the improvement of the Sacramento and Feather rivers, California." This appropriation was made March 3, 1875. At that time, due largely to the consequence of hydraulic mining, the depth on some of the bars in the Sacramento River in the 61 miles between its mouth, at Collinsville, and the city of Sacramento was but 4 feet, as compared with the depth of 7 feet which had previously existed. From Sacramento to Colusa, 91 miles, the stream was in favorable condition for navigation by boats drawing about 3 feet of water, but in the 110 miles from Colusa up to Red Bluff navigation was, as it is yet, difficult at numerous places on account of its changing and crooked channels, easily eroded banks, bars, and rapids. Many snags are also brought into this portion of the stream annually by high water. The bed of the Feather River had also been so filled up with débris from the hydraulic mines draining into it and its tributaries that navigation in the 30 miles between its mouth in the Sacramento and the head of navigation, at Marysville, was practicable during the higher stages only, usually extending from December to June. The same is true at the present time.

The present project for improvement (Reports of Board of Engineers printed in the Annual Reports of the Chief of Engineers for 1898, pp. 2944–2945, and for 1899, pp. 3171–3181) as adopted by the act of Congress approved March 3, 1899, and by subsequent acts, provides for obtaining and maintaining the following-named channel depths in the Sacramento River, by continuing the work of removing snags and other obstructions, and by the construction of wing dams to concentrate the flow at shoal places, at an estimated first cost of $280,000 and an annual expense of $25,000:

From—	To—	Miles.	Least channel depth to be obtained and maintained.
			Feet.
Mouth of river at Collinsville	Sacramento	61	7
Sacramento	Colusa	91	4
Colusa	Red Bluff	110	3
Total		262	

At the time the reports of the Board of Engineers above referred to were submitted the permanent improvement of the Feather River was not contemplated until the flow of sand and other mining detritus from the Yuba, Bear, and other tributaries should be stopped or the commercial interests involved became greater. Several appropriations have since been made, however, for the improvement of both the Sacramento and Feather rivers.

The sum of $943,286.62 was expended up to June 30, 1909, on both streams in the construction of wing dams, construction and operation of a snag boat and a snag scow, and the closing of several extensive breaks in the levees.

The expenditures have resulted in obtaining and maintaining the projected channel depths in the Sacramento from its mouth up to Colusa, and channel depths of 2 to 2½ feet from Colusa up to Red Bluff.

The expenditures during the fiscal year ending June 30, 1909, were for removing snags, cutting overhanging trees, dredging a channel through a bar about 3 miles below the city of Sacramento, and repairs to a snag boat.

The following statement shows the present conditions for purposes of navigation of the Sacramento and Feather rivers:

	Sacramento River.	Feather River.
Maximum draft that can be carried at low water.	San Francisco to Sacramento, 7 feet; Sacramento to Colusa, 4 to 5 feet; Colusa to Red Bluff, 2 to 2½ feet.	Mouth of river to Marysville, 1 to 2 feet.
Head of navigation	Red Bluff	Marysville.
Length, in miles, of navigable portions.	Mouth to Sacramento, 61 miles; mouth to Colusa, 152 miles; mouth to Red Bluff, 262 miles.	Mouth to Marysville, 30 miles.

The extreme variation of level of water surface at Red Bluff is about 22 feet, at Collinsville about 8 feet. Tidal influence extends up the Sacramento River to about the city of Sacramento.

The Sacramento River is important as the means for transporting both freight and passengers, steamboats plying regularly all the year round between San Francisco and Colusa, 202 miles, and during about seven months of each year (December to June) between San Francisco and Red Bluff, 310 miles. The Feather River is navigated at irregular times by light-draft steamboats from its mouth up to Marysville.

The freight carried on the Sacramento River during the year ending December 31, 1908, was approximately 425,000 tons, consisting principally of general merchandise and fruit upstream, and grain, fruit, vegetables, cord wood, and brick downstream. Approximately 150,000 passengers were carried during the past year. The average tonnage for the past thirteen years has been about 425,000. The maximum tonnage carried was in 1892, when it amounted to 579,574 tons.

Extensive areas of the land along the Sacramento River are under a high state of cultivation. Practically all of the territory along the river is dependent entirely upon the stream as a means of transportation for passengers and freight. In some instances the lower rates of the steamboat lines are met by railroads between the few points where the two meet in competition. Several new steamboat lines,

both freight and passenger, were established during the past year. The traffic on the Sacramento is now handled by 41 steamboats, 50 gasoline boats and launches, and 36 barges, and, in the lower portions of the stream, by a number of gasoline and sail schooners.

The existing project as adopted by Congress contemplates that the sum of $25,000 will be provided annually for the improvement of the Sacramento and Feather rivers. The $30,000 mentioned in the appended money statement as a profitable expenditure in fiscal year ending June 30, 1911, is necessary, in addition to the balance unexpended on June 30, 1909, to remove snags, bars, and other obstructions to navigation.

More extended information concerning the Sacramento and Feather rivers and their tributaries may be found in the document and reports referred to in the Annual Report of the Chief of Engineers for 1908 (pt. 1, p. 861) and in House Document No. 1123, Sixtieth Congress, second session.

Much of the country along a considerable portion of the Sacramento, Feather, and San Joaquin rivers and their tributaries is subject to widespread overflow during the winter and spring months of each year, the streams being unable to carry off the rainfall in the valleys and foothills and the melting snow in the mountains. Unrestricted hydraulic mining in earlier years has contributed largely to the difficulty by filling up the beds of the streams.

The interests of navigation, the problem of flood control, and the control and disposition of mine débris are all inseparably connected. These matters are in charge of the California Débris Commission, and that commission, in a report dated June 30, 1907 (printed in the Annual Report of the Chief of Engineers for 1907, pp. 2262–2269), in which the various questions are considered, states that dredging is considered the only feasible method of treatment.

SACRAMENTO AND FEATHER RIVERS.

July 1, 1908, balance unexpended	$19,693.69
Amount received from sales	30.50
Amount allotted from appropriation by river and harbor act approved March 3, 1909	25,000.00
	44,724.19
June 30, 1909, amount expended during fiscal year, for works of improvement	19,724.19
July 1, 1909, balance unexpended	25,000.00
Amount (estimated) required for completion of existing project	Indeterminate
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	30,000.00

Report on a recent survey of Sacramento River is printed in House Document No. 1123, Sixtieth Congress, second session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., November 9, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

The within is a report on the comprehensive survey of the Sacramento River from its mouth to Feather River, which was made as a result of favorable recommendations on a preliminary examination called for by the act of March 2, 1907. At the time

of the Board's investigation, which involved a public hearing and an inspection of the river, it was impressed with the magnitude and importance of the interests concerned.

The city of Sacramento is a prosperous distributing point, and its commerce both by rail and water is large. The lands adjacent to the Sacramento are extremely fertile and many of them are in a high state of cultivation under the system known as "intensive farming." The lands are naturally low, and those in use are protected by large levees, many miles of which have been built by property owners. The amount of produce grown in the immediate vicinity of the river is large in tonnage and is of great value. The river being narrow and inclosed between levees, boats are able to land practically at any point, thus affording direct communication by water. The total tonnage of the river is now about 500,000 tons, valued at over $22,000,000. There are still available for reclamation large tracts of lowlands which will no doubt be gradually taken up and the traffic correspondingly increased.

Local interests have expressed a desire for an improvement which will provide for a depth of 15 feet to Sacramento city, and 9 feet to the mouth of the Feather River. In order that the merits of the case might be fully considered, estimates were made for channels 6 and 9 feet in depth between Sacramento and the Feather River, and for 9, 12, and 15 feet in depth below Sacramento. These estimates are summarized as follows:

Between Sacramento and Feather River.

6-foot depth	$90,750
Annual maintenance	57,750
9-foot depth	311,500
Annual maintenance	207,500

Below Sacramento.

9-foot depth	$67,000
Annual maintenance	42,000
12-foot depth	330,000
Annual maintenance	160,000
15-foot depth	807,500
Annual maintenance	425,000

An examination of these estimates shows the great cost of maintenance. In fact, to make permanent any increase in depth in this river involves a work of continuous maintenance, experience indicating that any deepening of the channel will be largely obliterated during the next high-water season. The district officer states that a depth of 12 feet to Sacramento would be of little more value than a depth of 9 feet, as practically the same character of boats would use it, and that while a depth of 15 feet would induce some coastwise traffic, the amount of this commerce would not be sufficient to justify the great cost of such an improvement, In this view the Board concur, believing it to be impracticable at any reasonable cost to make a seaport of Sacramento city.

The district officer recommends a depth of 9 feet below Sacramento as being the most desirable, having in view the necessities of commerce and the cost of the work involved. Such a channel would afford facilities for large river steamers, tugs, and barges, and if its full dimensions are maintained it will provide for practically an unlimited commerce. While the cost of annual maintenance is large and equals the cost of original excavation, the Board believes that navigation and commercial interests in this locality are sufficient to warrant the expenditure involved, and it recommends the adoption of a project below Sacramento city for a channel 9 feet in depth and 200 feet in width, at a first cost of $67,000, including the necessary purchase of land, and an annual charge for maintenance thereafter of $42,000.

One of the most vital problems that confront the people of this section of the country is the question of flood control. The plan of improvement recommended herein for the benefit of navigation involves dredging only and will not conflict with any project that may be adopted in the interests of the more important question. The survey and its resulting maps and data should be of great value in the solution of the flood problems.

With reference to the section of river between Sacramento city and Feather River, the district officer states that it now has a depth of 4 feet, which is the depth provided for by the existing project between Sacramento city and Colusa, and that the controlling depth is a short distance below Colusa. There appears to be no particular advantage in having a greater depth below the Feather River than between that point and Colusa, as the same boats are used over the whole distance and the character of the commerce is the same. In view of these facts, the Board concurs

with the district officer and the division engineer in the opinion that Sacramento River between the mouth of Feather River and Sacramento city is not worthy at this time of improvement to a greater extent than is authorized by the existing project.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

SACRAMENTO AND FEATHER RIVERS; CALIFORNIA DÉBRIS COMMISSION.

Report of the California Débris Commission is printed in the Report of Chief of Engineers for 1907, Part 3, pages 2262 to 2269. Following is the concluding page.

Conclusions.—To summarize:

1. We concur in the opinion of our predecessors that dams in the high Sierras are inadvisable on account of cost per cubic yard of storage effected.
2. We believe that for the same reason it is inadvisable to attempt to divert the Yuba, Bear, or American into the "tules" or to construct settling basins or restraining barriers in the lower courses of the Bear or American.
3. We recommend that the Yuba River project be carried to completion, omitting the construction of barrier No. 2 and the reconstruction of barrier No. 1.
4. Of all practicable methods of accomplishing the second of the duties assigned to the commission, we believe that dredging in the navigable streams and possibly in the lower courses of the principal nonnavigable tributaries is the most feasible and advisable.

It has been urged against the dredging plan that any improvement of the Feather and of the Sacramento, above the city of Sacramento, will facilitate the progress of flood waters into the river below Sacramento and will therefore raise the flood plane in the lower river. To this the reply is obvious, that whatever work is done on the Sacramento and its tributaries must and will be done upon well-matured plans, in the preparation of which all elements of the problem will be taken into account. The jurisdiction of the commission is not confined to the Sacramento and its tributaries *above Sacramento*, but extends as well to the river below Sacramento. To quote the act:

"It shall be the duty of said commission to mature and adopt such plan or plans * * * as will improve the navigability of all the rivers comprising said system (the Sacramento and San Joaquin systems), deepen their channels, and protect their banks. Such plan or plans shall be matured * * * with a view of restoring as near as practicable and the necessities of commerce and navigation demand, the navigability of said rivers to the conditions existing in 1860."

Recommendations.—In pursuance of these conclusions and in compliance with the requirements of the act of March 1, 1893, the commission recommends as follows:

That for the direct improvement of navigation in the Feather and Sacramento rivers, and toward the controlling of débris and floods, an appropriation of $400,000 be made by Congress, its expenditure to be contingent on the appropriation of an equal amount by the State of California; these sums to be devoted to the construction of two hydraulic dredges and to their operation and maintenance, in accordance with the general terms of this report; provided, furthermore, that all rights of way for levees and spoil bank shall be furnished free of cost to the United States.

SAN JOAQUIN RIVER, CALIFORNIA.

Before improvement the channel below Stockton was crooked and difficult to navigate, with a depth of 6 feet and less at low tide. Above Stockton it was navigable only at high water for a few months of the year and carried but little commerce.

The first examination and survey was made in 1875. (See Report of the Chief of Engineers for 1875, p. 729.) In 1877 (see Report of the Chief of Engineers for 1878, p. 1302) a plan of improvement was submitted to dredge shoal parts to 6 feet and to cut off sharp bends. This project was modified from time to time. The present

project is generally to secure and maintain by dredging and by cut-offs a channel 9 feet deep and 100 feet wide to Stockton, and one 4 feet deep and 80 feet wide in Mormon Slough up to Miller's warehouse, as well as a temporary improvement of the upper river by snagging, dredging of bars, and partial closing of side channels. No definite estimate has been made for this project. The work done has been practically the use of such funds as were available to improve the worst stretches in the river as they developed year by year. Eight cut-offs have been made below Stockton by the United States and several by the State of California. The dredged depths and cut-offs have maintained themselves fairly well in the main river, but it has been impracticable, on account of the large amount of débris brought down by Mormon Slough, to maintain without continuous dredging navigable depths in Stockton channel, which is about 1½ miles in length and on which the city of Stockton is situated.

The total amount expended on the project up to June 30, 1909, was $553,142.34.

Navigation was kept open to Stockton the entire year. This would, however, not have been possible had not the city of Stockton, under permit of the War Department, constructed a dam near the mouth of Mormon Slough, which intercepts temporarily the flow of the slough, discharging it into the San Joaquin River above the mouth of Stockton channel, after passing over a wide tract of land on which most of the material carried is deposited.

This unfavorable condition at Stockton channel will be largely remedied by an intercepting canal, which is now under construction.

The maximum depth that could be carried to Stockton at mean low tide on June 30, 1909, was about 6 feet. The extreme tidal range is about 3 feet; the freshet range about 12 feet. The distance from Stockton to the mouth of the San Joaquin River is about 45 miles. At high water boats go occasionally to Hills Ferry, 150 river miles above Stockton.

The commerce of the San Joaquin River is reported by the two large steamship companies and individual vessel owners as reaching 509,233 tons during the year 1908, valued at $21,716,334, exclusive of the freight carried by the steam and gasoline launches plying between Stockton and the many river islands which are under cultivation, and which carry large amounts of supplies and produce, but of which no accurate account can be obtained. Nearly all of this freight is carried on the lower San Joaquin River below Stockton, the commerce of the upper San Joaquin being small.

The nature of the commerce has not been changed by these improvements. The improvements have undoubtedly had effect on freight rates, though the amount can not be ascertained.

Funds appropriated will be used in dredging and snagging for the extension of benefits.

The amount estimated as required for the fiscal year 1911 will be used for maintenance of improvement, for dredging any shoal places, and removing any other obstructions to navigation that may develop.

July 1, 1908, balance unexpended	$1,733.06
Amount allotted from appropriation by river and harbor act approved March 3, 1909	20,000.00
	21,733.06
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	205.40
July 1, 1909, balance unexpended	21,527.66
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	[a] 35,000.00

Report on a recent survey of San Joaquin River is printed in House Document No. 1124, Sixtieth Congress, second session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., November 16, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

After holding a public hearing at Stockton, Cal., which was attended by a large number of deeply interested persons, and making an examination of San Joaquin River and Stockton Channel, the Board concluded that a complete and comprehensive survey, with estimates of cost of channels of varying dimensions, should be made to aid in determining the advisability of undertaking the further improvement of this waterway. This survey has been made and the within report submitted.

The report contains estimates for channels 15, 12, and 9 feet in depth, with widths of 300 and 200 feet for the 15-foot channel and 200 feet for the 12 and 9 foot channels. The district officer is of opinion that a width of 300 feet is not too great for a channel way 15 feet in depth, and in this opinion the Board concurs. The plan proposed provides for three cut-offs, referred to as A, B, and C. The work involved at C is quite small and the Board considers this cut-off necessary in the interests of navigation. It will also be of advantage for the reason that Calaveras River will then empty into the bend of the old river, which will act as a settling basin and catch considerable deposit that otherwise would flow into the steamboat channel. Cut-off B is not strictly necessary for the passage of boats, but it would be a decided convenience. The radius of this bend is but 1,000 feet, and if in the future greater channel dimensions are found advisable to accommodate larger boats than those now in use, the cut-off would become a necessity. It would also be advantageous in aiding in the run-off of flood waters, and in view of all these facts, cut-off B is deemed advisable. Cut-off A would merely be a convenience by shortening to a slight extent the distance to be traveled. The bend is not sharp and the channel way is wide and deep. This cut-off is not deemed necessary, and is not recommended.

While the district officer believes a depth of 15 feet at this time is inadvisable, he recommends securing the right of way for the width which would be required if the 15-foot project were adopted. He states that its cost would be very much less at the present than at some future time, and in view of the possibility of its being required he recommends that the full-width right of way be now secured as a matter of economy. The estimates of the district officer are as follows:

9-foot project, 200 feet wide, with 300 feet right of way, including cut-offs	$264,000
Including only cut-off C	230,000
If only right of way for 200-foot width is secured	210,000
Annual maintenance	25,000
12-foot channel, 200 feet wide, with cut-offs	340,000
15-foot channel, 300 feet wide, with cut-offs	800,000
200 feet wide	500,000

No estimate for the maintenance of the 12 and 15 foot channels is given.

For reasons stated in his report, the district officer recommends the adoption of a project for a channel 9 feet in depth and 200 feet in width in preference to either of the others. He believes that a depth of 12 feet would be of very little more value

[a] This amount includes an item of $5,000 for maintenance of Stockton and Mormon channels after completion of the improvement now in progress.

than one of 9 feet, as practically the same class of boats would have to use it; and while a depth of 15 feet would probably be used to some extent by light-draft coastwise vessels, he believes that the benefits to this traffic would not be sufficient to warrant the large sum involved in the improvement. In this opinion the Board concurs. On a depth of 9 feet large river boats, tugs, and barges can be accommodated, and practically an unlimited amount of commerce carried. Interested parties earnestly advocated a depth of 15 feet, in the belief that an ocean-going commerce would be established. The Board does not believe that this could be done on a depth of 15 feet, and it is obvious that the cost of any greater depth would be prohibitive. The Board therefore concurs in the conclusion of the district officer that a depth of 9 feet is the most desirable to adopt in the interests of general commerce, and it believes that this depth will fully meet the requirements of navigation.

Stockton is a thriving city with a large commerce. The adjacent country is in a high state of development, and the lowlands along the San Joaquin are rapidly being reclaimed and placed under cultivation. The products of these fertile lands constitute an important part of the commerce of the San Joaquin River, which is now reported to amount to over 700,000 tons, having a value of about $25,000,000.

The Board concludes from a study of available information that San Joaquin River and Stockton channel are worthy of improvement by the General Government to the extent of providing a channel 200 feet bottom width and 9 feet in depth, with two cut-offs referred to in the within report as B and C, the location of which is approximately shown on the accompanying map, and a sufficient right of way to permit of increasing the dimensions of the waterway should this become desirable in the future. The estimated cost of the work proposed by the Board, derived from the estimates submitted within, but which do not provide for the exact items proposed by the Board, is approximately $240,000, and $25,000 annually for maintenance.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

SUISUN CHANNEL, CALIFORNIA.

Report on a recent survey is printed in House Document No. 1110, Sixtieth Congress, second session.

Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 4, 1908.

SIR: I have the honor to submit herewith for transmission to Congress reports of March 18, 1908, and August 24, 1908, with map, by Lieut. Col. John Biddle, Corps of Engineers, on preliminary examination and survey, respectively, of Suisun Channel, California, authorized by the river and harbor act approved March 2, 1907.

Suisun Channel is usually known as Suisun Creek and is also called Suisun Slough. At its head at the town of Suisun the channel is practically bare at low water and navigation can take place only at high tide.

The plan of improvement proposed provides for securing a channel up to Suisun, 6 feet deep at low water, by dredging and making a cut-off just below the town. The work recommended is estimated to cost $25,000, with $2,000 annually for maintenance after completion.

In view of the existing and reasonably prospective commerce the district officer and the Board of Engineers for Rivers and Harbors regard this locality as worthy of improvement to the extent indicated, provided the land needed for the cut-off is deeded to the United States free of cost, and in this opinion I concur.

Very respectfully,

W. L. MARSHALL.
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

Suisun Channel or Creek is a tidal slough heading at the town of Suisun and emptying into Suisun Bay. Its length is about 17 miles, It flows through marsh land, except at a point called Rush Landing. where it flows for half a mile or so along what is known as Potrero

Hills. The depth and width below Rush Landing are ample and seem permanent, although the stream is very crooked. The depths through Suisun Bay are also sufficient. Above Rush Landing the creek is tortuous, narrow, and shallow. Much of it, including the wharves at Suisun, is bare at low tide. Navigation can take place only at high tide. The extreme tide is about 7 feet. The result is that boat service is irregular and uncertain.

The improvements desired are the widening, straightening, and deepening of the channel, so that boats can come at all stages. Navigation is by small launches and scows. The shipments in 1905 are estimated at about 20,000 tons, consisting of grain, hay, fruit, vegetables, and general merchandise. The shipping is mostly to and from the towns of Suisun and Fairfield, which are adjacent, but also from the inland towns of Elmira and Vacaville, 10 or 12 miles distant, from which points it is hauled by wagons. A regular schedule of boats would, it is said, greatly increase the traffic with the two latter places.

There has recently been established within 5 miles of Suisun, on a branch of the Southern Pacific Railroad, the Pacific Portland Cement Company. This company ships via the railroad, and states that it has suffered greatly, due to inadequate car service. The cement company states that if the creek be made navigable the company will construct 3 miles of railway, costing $250,000, to make connection with the water, and estimates an output of 300 tons a day. The oil for the plant is now brought by schooner to Suisun and pumped up. A better channel would undoubtedly aid and cheapen this delivery.

The Board of Trade of Suisun estimates a possible commerce of 400,000 tons.

COOS BAY AND BAR ENTRANCE, OREGON.

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 958, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., May 11, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

The within report on a survey of Coos Bay and bar covers quite fully past and present physical and commercial conditions at this locality. The survey extended to the town of Marshfield, 13 miles above the entrance to the harbor. In this stretch there are a number of shoals with a depth of 12 to 14 feet over them at low water. As indicated within, the jetty constructed at the entrance has been very successful, the depth having been increased within a few years after work was started from 10 feet to 20 feet, and this depth has since maintained, although the outer portion of the jetty has been repeatedly beaten down by wave action during storms. This jetty has been twice restored, once prior to 1897, by the addition of 159,000 tons of stone, and again in 1900, when 209,000 tons of stone were added, raising the outer 1,000 feet to a height of from 20 to 29 feet above low water, and although the pieces weighed up to 17 tons each, the outer 800 feet has again subsided to a depth of from 5 to 20 feet below low water. This work, including repairs, has cost approximately $700,000.

The improvement now desired is some additional depth at the bar entrance and the cutting of suitable channels through the shoals up to the town of Marshfield, so as to permit vessels of moderate size to use the bay at all stages, and the largest ones likely to come in at high stages. It is stated that 18 feet in the bay at mean low tide and some increased depth at the bar will meet these requirements. To secure this end, the district officer presents two plans, the first one involving dredging alone at a cost of $500,000 and an annual expenditure for maintenance of $60,000. The other plan

includes all work proposed under the first plan, and, in addition thereto, provides for restoring the north jetty where beaten down, extending it 1,000 feet farther and building a south jetty 2,500 feet long. The cost of this plan is $2,700,500, with an annual cost for maintenance of $60,000. After discussing the commerce of the port, present and prospective, the district officer concludes that the expenditure involved in the more certain though expensive plan is not justified, but that the locality is worthy of improvement under the first plan suggested.

After a full study and discussion of the subject, the Board has arrived at the conclusion that the work of restoring and extending the jetties is not justified by the present and prospective commerce involved, but that the locality is worthy of improvement by dredging in accordance with plan 1, contained within, at an estimated cost of $500,000. This plan has the decided advantage of providing a first-class seagoing dredge which may perhaps be available for use at other localities, if it is found from experience that its use will not be continuously required at Coos Bay to maintain the necessary depth.

For the Board.

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

The estimated cost of project No. 1, as above outlined, is as follows:

Hydraulic seagoing dredge	$350,000
1,000,000 cubic yards dredging, at 12 cents per cubic yard	120,000
Superintendence and contingencies	30,000
Total	500,000
Annual maintenance:	
Dredging on bar	50,000
Dredging inside channel	10,000
Total	60,000

The project for the present jetty was submitted in 1889. The tons of freight transported into and out of Coos Bay in that year are not on record, but were probably not less than that of 1886, say, 110,000 tons. By 1894 the projected depth of 20 feet on the bar had been obtained, and the tonnage for that year was practically the same as in 1886 and 1889. From 1894 there was a gradual increase in the tonnage to 144,934 in 1896, then a falling off to the low record of 97,500 tons in 1901. The real start dates from 1901. Since that year the tonnage has steadily increased to 178,945 tons in 1905 and 184,455 tons in 1906. The record for 1907 is not yet available, but it will show a marked increase over that of 1906, and that of 1908, which will include the output of a new lumber mill of 500,000 feet daily capacity, will show a still further advance over the record of 1907.

TILLAMOOK BAY AND BAR, OREGON.

Tillamook Bay is an indentation of the Oregon coast, about 6 miles long and about 3 miles wide, and lies about 50 miles south of the entrance to the Columbia River. At low tide the bay inside the bar is a succession of sand and mud flats, separated by several channels, which shoal to a low-tide depth of about 1 or 2 feet. The bar at the entrance to the bay has a controlling channel depth, generally, of about 14 feet at mean low tide. Vessels drawing from 14 to 15 feet can reach Hobsonville, on the north channel, a short distance inside the entrance. Originally the controlling high-water depth between the ocean and the town of Tillamook, on Hoquarten Slough, 12 miles from the entrance, did not exceed 7 or 8 feet.

The original project for the improvement was adopted by the river and harbor act of August 11, 1888, and provided for a survey of the entrance, and for the improvement of Dry Stocking bar and Hoquarten Slough by the building of pile dikes, at an estimated cost of $5,200. The total amount expended on this project was $5,700.

The existing project adopted by the act of July 13, 1892, provided for connecting the north and middle channels nearly opposite Bay City, putting in dikes at Junction and Dry Stocking bars, and contemplated a least depth of 9 feet at mean high tide from Hobsonville to Tillamook City. The estimated cost was $100,000.

The amount expended on the existing project at the close of the fiscal year ending June 30, 1909, was $120,110.34, of which amount $47,636.97 was applied to maintenance. There was received from sales the sum of $20.

Snagging and dredging operations were in progress during the summer and fall of 1908, were commenced again in June, and are still in progress, with a view to maintaining the projected depth of 9 feet to Tillamook City.

All of the work contemplated by the project has been completed, and, except as shoals are formed by each freshet, boats have experienced little difficulty in reaching Tillamook City at high tide on a draft of 9 feet. The average range of tide is 6.2 feet. The head of navigation for ocean-going vessels is at Tillamook City, about 12 miles from the entrance.

Lumbering is one of the chief industries, and logging is extensively carried on, most of the tributaries of Tillamook Bay being utilized as a means of floating the logs down to tide water.

The commerce on Tillamook Bay consists of lumber and dairy products shipped to Portland and San Francisco, and general merchandise brought in by coasting vessels. During the calendar year this traffic amounted to 19,400 tons, valued at $1,098,990.

There is no railroad connection with Tillamook Bay, but construction has been started on a projected line beginning at Hillsboro, just west of Portland, and which is intended to connect the Southern Pacific with a terminus on Tillamook Bay.

The amount estimated as a profitable expenditure is for maintenance by dredging and snagging, and the work is necessary to make the improvement available for vessels drawing 9 feet at high tide.

For reports on examinations and surveys, attention is invited to Annual Reports of the Chief of Engineers for 1888, page 2150; 1892, page 2742; 1898, page 3007; and 1903, page 2239. The report of survey made in 1907 is published as House Document No. 965, Sixtieth Congress, first session.

Comparative statement of traffic.

Calendar year.	Tons.	Estimated value.	Calendar year.	Tons.	Estimated value.
1899	36,835		1904	13,823	$658,489
1900	17,640		1905	13,919	696,760
1901	21,147		1906	13,627	850,240
1902	24,883		1907	22,917	1,246,710
1903	16,862		1908	19,400	1,098,990

July 1, 1908, balance unexpended	$2,480.83
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	7,480.83
June 30, 1909, amount expended during fiscal year for maintenance of improvement	2,571.17
July 1, 1909, balance unexpended	4,909.66
July 1, 1909, outstanding liabilities	2,176.00
July 1, 1909, balance available	2,733.66
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

Following is the report of the Board of Engineers on a recent survey of Tillamook Bay and Bar, printed in House Document No. 965, Sixtieth Congress, first session, and concurred in by the Chief of Engineers:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., April 4, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

The survey of Tillamook Bay up to the town of Tillamook indicates that the project depth for the improvement of this reach, 9 feet at mean high tide, has been attained, and that there is at present a depth 2 feet in excess of that called for by that project. The commerce which utilizes this channel is furnished by several small localities, the principal ones being Garibaldi, Hobsonville, Bay City, and Tillamook. The greater part of the commerce, it appears, is furnished from the town of Tillamook, which is the most important settlement in this vicinity.

After going into this subject quite carefully, the district officer states that the only improvement which seems to be warranted by the present and prospective commerce of the port is the maintenance of existing depths. He believes the locality is worthy of improvement to this extent, and estimates that it will require an expenditure of $5,000 annually to attain this end. In addition to the estimate for maintenance, he recommends an appropriation of $5,000 with which to restore to a fair condition the dikes previously constructed.

In a communication received by the Board from Mr. Samuel Elmore, president Pacific Navigation Company, in response to an invitation to interested parties to express their views regarding the necessities of this improvement, it is stated—

"Our company operates the only line of vessels plying to Tillamook Bay and Tillamook City. * * * To improve the bar, in our opinion, means the building of two jetties, one on the north side and another on the south side. The commerce of the country tributary to the bay will not justify this outlay, and therefore we think if the Government will expend sufficient each year to keep the present channels clean from snags and shoal spots, aside from widening the slough at Tillamook City, which we feel satisfied can be covered by the proposed appropriation, then all parties should be satisfied, as we, the principal ones interested, certainly will be. We commend Lieutenant-Colonel Roessler's report."

After further consideration of the questions involved, the Board has arrived at the conclusion that the commerce, present and prospective, is insufficient to warrant any improvement of the bar entrance to this harbor, and it concurs with the district officer in believing that the only work warranted by existing commerce is the maintenance of present depths and the repairs absolutely necessary for the preservation of the dikes already constructed.

In view of the above, the Board recommends an appropriation of $5,000 for urgent repair work and $5,000 annually for maintenance.

CLATSKANIE RIVER, OREGON.

The Clatskanie River rises in the Coast Range and empties into the Columbia River 65 miles below Portland, Oreg. Before it reaches the Columbia it winds for 3 miles through marshy lowlands, and by a

narrow, tortuous channel. Before improvement the obstructions to navigation were a single shoal with but 2 to 3 feet of water, and two sharp bends below the town of Clatskanie.

The original and present project was adopted by the act of March 3, 1899, and provided for dredging out the shoal and cutting off the two sharp bends by means of dredging, at an estimated cost of $13,000.

There has been expended on this work, to the close of the fiscal year, the total sum of $12,675.47, of which sum $868.10 was applied to maintenance. There has been no work done during the past year, as the amount available was not sufficient to accomplish any results.

A permit was granted to the Columbia Agricultural Company, under date of January 5, 1909, to dredge across a bend near the mouth for the purpose of diking some of the low land. This work was commenced in June.

All of the work contemplated under the present project was completed in 1902, and resulted in giving a depth of 5 feet over the shoalest places, and in making the channel shorter by 4,050 feet and easier of navigation. Clatskanie, a small town 3 miles above its mouth, is the head of navigation, and at the close of the fiscal year about 3½ feet could be carried over the shoalest part of the channel.

The whole stretch of the river is tidal, with a variation of water level, due to tides only, of about 5 feet. The backwater of the Columbia, during freshet time, raises the river to a maximum height of about 10 feet.

The stream is used extensively for logging purposes, as there are fine forests of fir, hemlock, spruce, and cedar along its banks, reaching to the headwaters.

The commerce of Clatskanie River consists principally of sawmill products, farm and dairy products, and general supplies. During the calendar year 1908 this commerce amounted to 46,382 tons, valued at approximately $381,492.

The Astoria and Columbia River Railroad crosses the valley about 1½ miles from the town of Clatskanie, but the greater portion of the business is done by boat, because of the cheaper rates for transportation. The commerce is handled by a boat making three trips per week between the towns of Clatskanie and Portland.

Since the completion of the improvement shoaling has taken place, and the amount estimated as a profitable expenditure is for the purpose of redredging the shoals and furnishing better facilities for the increased commerce.

The total amount estimated as a profitable expenditure should be appropriated, owing to the fact that the balance remaining of the old appropriation ($324.53) has been returned to the surplus fund, as provided by section 10 of the act of March 4, 1909.

For further information regarding this improvement, attention is invited to the Annual Report of the Chief of Engineers for 1898, page 3049, and House Document No. 134, Fiftieth Congress, first session.

Comparative statement of traffic.

Calendar year.	Tons.	Estimated value.	Passengers.
			Number.
1899	68,126	.....	5,210
1900	88,622	.....	5,305
1901	51,967	.....	2,136
1902	23,790	.....	1,180
1903	25,765	.....	494
1904	18,861	$444,210	525
1905	16,408	612,970	.....
1906	10,339	216,630	.....
1907	22,925	280,616	502
1908	46,382	381,492	422

July 1, 1908, balance unexpended	$324.53
Reverted to the surplus fund, as provided by section 10 of act of March 4, 1909	324.53
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement	500.00

COOS RIVER, OREGON.

Coos River is the principal tributary of Coos Bay and empties into the bay at its head, opposite the town of Marshfield. At a point 5½ miles from its mouth the river divides into two branches, known as the "North" and "South" forks, up each of which tidal influence extends for about 8½ miles. Before improvement was commenced the small light-draft steamboats and launches plying between Marshfield and the head of tide on each fork experienced considerable difficulty in navigating on account of the many snags, bowlders, etc., in the stream.

The original and existing plan of improvement, based on the survey made in 1894 (Annual Report of the Chief of Engineers for 1895, pp. 3502–3505), proposed the removal of all snags and bowlders from a selected channel 50 feet in width in the main river and on both the North and South forks to the head of navigation. The estimated cost was $5,000, but in 1898 it was stated in the annual report that $3,000 additional would be required to complete the project, and in 1900 it was estimated that an appropriation of $1,500 every two years would be required for maintenance.

The amount expended on the project to June 30, 1909, was $14,336.30, of which $6,336.30 has been applied to maintenance.

No work was done during the fiscal year, as the channel was in fairly good condition and sufficient funds were not available to warrant repairing and putting the plant into commission.

The project may be considered as completed, and the work done has resulted in a safer and better channel for the small craft plying the stream. The maximum draft that can be carried at low tide over the upper reaches is about 1½ feet. The range of tide is about 2½ feet, so that boats drawing 4 feet navigate to the head of tide water on both the North and South forks, a distance of about 14 miles above the mouth. Logging from the extensive forests along the upper reaches of this stream is one of the main industries, and the logs are floated down to the booms in the lower reaches of the river and towed to the mills along the bay.

The valley is very fertile, and the commerce is mostly farm and dairy products, logs, and lumber. The produce is carried in small steamers to Marshfield, where it is loaded in ocean steamers and taken to the San Francisco and Portland markets. This traffic amounted during the calendar year 1908, including supplies, machinery, etc., received, to 36,697 tons, valued at $1,679,161.

The maintenance of the improvement is a benefit to navigation, and is essential to the economical and safe operation of steamboats.

The amount estimated as a profitable expenditure is for the purpose of snagging and dredging for maintenance of the improvement, and will be so applied.

For reports on examinations and surveys reference is invited to the Annual Reports of the Chief of Engineers for 1893, page 3437, and 1895, page 3502.

Comparative statement of traffic.

Calendar year.	Tons.	Estimated value.	Calendar year.	Tons.	Estimated value.
1899	[a] 70,007		1904	49,907	$1,033,758
1900	[b] 229,225		1905	44,398	1,179,974
1901	62,402		1906	35,537	1,246,684
1902	[c] 46,000		1907	42,073	1,613,948
1903	28,109		1908	36,697	1,679,161

[a] Includes 21,852 tons of stone for the government jetty at the entrance to Coos Bay, Oregon.
[b] Includes 170,400 tons of stone for the government jetty at the entrance to Coos Bay, Oregon.
[c] Approximate.

July 1, 1908, balance unexpended	$1,663.70
July 1, 1909, balance unexpended	1,663.70
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	3,000.00

COQUILLE RIVER, OREGON.

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 399, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., October 28, 1907.

Respectfully returned to the Chief of Engineers, U. S. Army.

The survey of Coquille River indicates that the obstructions to be removed, to provide suitable navigation, consist of five submerged rocks at and near the mouth of the river, and three shoals above.

The district officer estimates that the work contemplated will cost $27,840, and that future maintenance will amount to $4,000 annually. He expresses the opinion that the improvement is worthy of this expenditure.

A large sum has already been expended on this improvement and the results have been satisfactory. A commerce of considerable size and value has developed and is increasing. The rocks and shoals referred to endanger this commerce and prevent the full benefits of the improvements already made being realized.

In the opinion of the Board, the cost of the work now proposed is reasonable when compared with the additional advantages that will probably result therefrom, and it believes it is desirable that the United States undertake the work.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

The commerce is carried on in small coasting steamers and schooners, which ply between the various mills along the 25 miles of the river above its mouth and San Francisco. The vessels carry into the port chiefly mill and farm machinery and miscellaneous supplies. The Coquille Valley has great undeveloped resources, and the commerce of the port has more than trebled in the last ten years, as may be seen by the following comparative statement of traffic:

Calendar year.	Tons.	Estimated value.
1896	21,106	.....
1897	25,620	.....
1898	24,550	.....
1899	26,654	.....
1900	30,727	.....
1901	32,975	.....
1902	37,458	.....
1903	48,249	.....
1904	60,944	$1,332,058
1905	45,455	1,105,750
1906	67,288	1,119,716

WILLAMETTE RIVER ABOVE PORTLAND, AND YAMHILL RIVER, OREGON.

The Willamette River rises in the Cascade Range, flows northerly, and generally parallel to the coast line, and empties into the Columbia about 12 miles below Portland and 100 miles from the sea.

The Yamhill River is a tributary which has its source in the Coast Range, flows in a northeasterly direction, and enters the Willamette 40 miles above its mouth.

Prior to improvement both streams were obstructed by drift, snags, rock ledges and rapids, and gravel shoals, which prevented navigation during low-water stages. In early days the river formed the only means of transportation, and carried large quantities of grain and farm products to the Portland market, notwithstanding the difficulties of navigation.

Reference is invited to Annual Reports of the Chief of Engineers for 1876, page 654, and 1880, page 2280, for a description of the Willamette River before improvement.

The original project was adopted in 1870, the first appropriation being made by the act of March 3, 1871. This project was modified in 1878 and 1896, and provided for improvement by the removal of snags and other obstructions, and the deepening of gravel shoals by scraping and by contraction works. The modification of 1896 also provided for the construction of a lock and dam in the Yamhill River below Lafayette, at an estimated cost of $69,000.

The total amount expended on the work prior to adoption of the present project was $247,747.51.

The present revised plan or project (see Annual Report of the Chief of Engineers for 1904, p. 3529) provides for improvement below Corvallis, with a view to obtaining, mainly by dredging, auxiliary dam and revetment work, and by snagging, a low-water depth of 2½ to 3½ feet from Corvallis to Oswego, and a low-water depth of 12 feet thence to Portland. The plan allows snagging above Corvallis to Harrisburg, but above the latter point the channel is to be left as not worthy of further improvement. The estimated cost of carrying on the work was given as $213,500.

The amount expended on the existing project to the close of the fiscal year was $398,004.74, which includes $3,000 expended on the Long Tom River and $175,384.06 for maintenance.

The work is carried on by use of government plant, consisting of a combined dredge and snag boat, one dipper dredge, and one pile driver. During the past year snagging, dredging, and revetment work was carried on from July 1, 1908, to November 30, and April, 1909, to June 30, 1909, and different shoals were dredged between Corvallis and Newberg. A total of 77,579 cubic yards of material were removed from the channel, and a total of 730 snags were removed from the channel and banks between Corvallis and Newberg, and repairs were made to revetment and dikes at Wheatland, Independence, and Five Islands.

The work done on the Willamette River has greatly improved the conditions, and, with annual maintenance, will furnish a navigable channel at medium stages to Corvallis, 119 miles above Portland, and during low water to Independence, 83 miles above Portland, and to Dayton, on the Yamhill River, 8 miles above its mouth. The head of navigation on the Willamette is Harrisburg, 152 miles above Portland, but boats reach the latter point only on the higher stages.

The work done on the Yamhill River has been the completion of the lock and dam near Lafayette, about 8 miles above the mouth, under project of 1896, and clearing the channel of obstructions.

The head of navigation on the Yamhill River is McMinnville, 18 miles from the mouth, but boats seldom go above Dayton.

The forests adjacent to the Willamette Valley produce large quantities of logs, and most all of the tributaries are used for logging purposes, for distances ranging from 20 to 45 miles. An annual log drive takes place each spring on the Willamette, between the upper river points and Newberg.

The commerce consists of lumber, grain, hay, hops, potatoes, fruit, and garden truck. This commerce, including general merchandise and supplies received and logs towed, amounted, during the calendar year 1908, to 403,148 tons, valued at $8,014,164.

The falls of the Willamette at Oregon City, 12 miles above Portland, and around which a canal and lock were constructed in early days by private capital, furnish a very large water power. This water power and the locks are controlled by the Portland Railway, Light and Power Company, and a charge of 50 cents per ton is made for all traffic which passes through the locks. During the calendar year this traffic amounted to 73, 578 tons, not including large quantities of logs and timber. The falls furnish power for the main generating plant of the above company, also for large woolen, lumber, and paper mills.

The lands of the Willamette Valley are very rich and productive, and the products are annually increasing. The river furnishes an easy means of transportation, and carries a large proportion of these commodities.

The Southern Pacific Railway practically parallels the river on each side, and the Oregon Electric Company is now operating an electric line between Portland and Salem.

Although the locks in the Yamhill River are little used, these locks, together with the water transportation furnished by the Willamette, are instrumental in reducing the freight rates on all shipments from valley points.

The amount estimated as a profitable expenditure is to be applied to construction of revetments, dredging, snagging, and making repairs to existing works. The work is necessary to maintain the available channel.

Comparative statement of traffic.

Calendar year.	Tons.	Estimated value.	Passengers.
1899	117,782	.....	50,738
1900	182,458	.....	47,324
1901	191,901	.....	103,971
1902	192,227	.....	95,221
1903	236,823	.....	66,510
1904	332,130	$11,260,196	65,947
1905	362,258	12,119,596	67,396
1906	383,911	7,591,623	41,160
1907	412,846	8,193,746	41,998
1908	403,148	8,014,164	29,029

July 1, 1908, balance unexpended	$19,708.32
Amount allotted from appropriation by river and harbor act approved March 3, 1909	20,000.00
	39,708.32
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	21,960.57
July 1, 1909, balance unexpended	17,747.75
July 1, 1909, outstanding liabilities	2,168.00
July 1, 1909, balance available	15,579.75
Amount (estimated) required for completion of existing project	103,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	60,000.00

COLUMBIA AND LOWER WILLAMETTE RIVERS BELOW PORTLAND, OREGON.

The portions of the rivers covered by this improvement include the 12 miles of the Willamette between Portland and its mouth and 98 miles of the Columbia from the mouth of the Willamette to the sea. The original condition of the channel from Portland to the sea was such that only from 10 to 15 feet could be carried over shoal places at low water. Numerous sand bars obstructed navigation by deep-water craft, and on these bars the water was spread over an extended area, so that the channels through them were comparatively narrow. The value and availability of this waterway for purposes of commerce are illustrated by the fact that Portland is one of the principal grain-exporting cities in the United States, the valley of the Columbia being a natural outlet for the products of Oregon, Washington, and Idaho.

Prior to the adoption of the project, dredging had been done for temporary relief, and the sum of $221,780.46 expended for that purpose. The original project was adopted in 1877, with a view to obtaining a channel depth of 20 feet. In 1891 the project was extended, with a view to obtaining a low-water channel of 25 feet, at an estimated cost of $772,464, and the Port of Portland Commission, a corporation existing under the laws of the State of Oregon, was granted permission to assist in the work. On the original and modified project, exclusive of the amounts named above, there has been expended the sum of $1,080,874.11. This does not include

any part of the expenditures which have been made by the Port of Portland Commission.

The present project was adopted by the act of June 13, 1902. It is based on a survey made in 1900, which is printed in the Annual Report of the Chief of Engineers for 1900, page 4418. The project proposes a 25-foot channel, by the construction of controlling works and by dredging. The estimated cost was $2,796,300, with $175,000 as the cost of the new dredge and accessories.

The total amount expended on this project to the end of the fiscal year was $509,962.09. This amount does not include any portion of the sum expended by the Philadelphia district for dredge construction, and it may be stated that all the expenditures have been applied to maintenance. The total amount received from miscellaneous sources, account of sales, is $623.78.

The act of March 2, 1907, appropriated $300,000 for constructing and operating a dredge. This dredge was constructed on the Atlantic coast and was delivered at Portland April 21, 1909. The amount expended on her construction, including expenses of voyage from Philadelphia, Pa., was $303,543.86, and for details of the work see Appendix H 10.

The work of progress on the Columbia River during the year has consisted entirely of dredging over some of the most obstructive shoals. A total of 341,430 cubic yards of material was removed at the different shoal places in the estuary of the Columbia with the dredge *W. S. Ladd*. The Port of Portland Commission also operated its dredges in the upper reaches when funds were available and when dredging was required. The commission reports having removed a total of 2,326,568 cubic yards during the year. The new dredge *Clatsop*, constructed under the supervision of the Philadelphia (Pa.) district, arrived at Portland the latter part of April. She was overhauled and commenced dredging on June 25, and to the close of the fiscal year removed 16,504 cubic yards of material.

Thus far none of the permanent works provided for in the project have been constructed, as operations have consisted principally in dredging, and no part of the project can therefore be considered as completed. The maintenance of the channel has been of great advantage to shipping, and there has been no time during the year when a vessel could not safely load to a draft of 24 feet. The ruling depth at mean low water from Portland to the sea is about 22 feet, except at two places, Upper Sands and Taylor Sands, where the depths are only 21½ feet and 20 feet, respectively; but by taking advantage of the tides vessels have experienced little delay.

The head of deep-water navigation is at Portland, Oreg., on the Willamette River, 110 miles above the mouth of the Columbia. Light-draft boats ascend the Willamette for 150 miles, and by using the state portage road between Celilo and Big Eddy cargoes of light-draft boats during high stages reach Pittsburg Landing, a point on the Snake River 537 miles above the mouth of the Columbia. The Columbia and Willamette rivers over this stretch probably form the greatest waterway for logging and rafting purposes in the United States. Lumber and shingle mills are located along the banks, and logs are floated down all the tributaries from points 20 to 90 miles inland and towed to the different mills to be manufactured. During the calendar year 1908 seven rafts of logs and piling timbers, aggregating, approximately, 35,000,000 feet b. m., were made up in the

Columbia River and towed to San Francisco and southern California ports.

The export commerce consists principally of grain and lumber, while the imports are composed principally of oriental products, cement, coal, lime, sulphur, etc. The light-draft tonnage is chiefly dairy, farm, and lumber products and miscellaneous machinery and mercantile supplies.

The total commerce handled during the calendar year 1908 amounted to 4,615,372 tons, valued at approximately $70,509,475.

It is not believed that the completion of the project will have any effect on freight rates until greater depths are obtained over the bar at the entrance to the Columbia River, thus allowing the use of ships of greater draft and carrying capacity.

The amount estimated as a profitable expenditure is to be applied to maintenance by dredging and making repairs to dikes and revetments. The maintenance of the channel is essential, pending the construction of permanent contraction works, the estimate for beginning these works being deferred in order that projects of special character, such as The Dalles-Celilo Canal and the purchase of the private canal in the Willamette River at Oregon City, may be provided for by adequate appropriations or by authorization of contracts.

The two channels around Swan Island, below Portland, originally divided the current of the river to the detriment of both. A shoal bar existed at the head of each channel. To remove that of the east channel, a dike was constructed across the head of the west channel. The east channel, which is used by all vessels, is very crooked at one portion, and it is sometimes difficult to avoid collision between deep-sea vessels and log tows. The latter are the main source of worry to the deep-sea navigators in the Swan Island channel. There is a general desire to have the west channel dredged out to a sufficient depth to accommodate log tows. This improvement is deemed a necessary one in view of the increasing commerce of this port. In making appropriation for the improvement of the ship channel, it is recommended that so much of the money as may be necessary be authorized for dredging out the west channel to such extent as may be necessary to accommodate log tows. A gap 300 feet wide has been left in the dike in the west channel to permit the passage of shoal-water boats.

References to former reports are given on page 683 of the Annual Report of the Chief of Engineers for 1905.

Comparative statement of traffic.

Calendar year.	Handled by river vessels.		Handled by seagoing vessels.				Handled by river and seagoing vessels.	
	Quantity.	Estimated value.	Receipts	Shipments.	Total.	Estimated value.	Quantity.	Estimated value.
	Tons.		*Tons.*	*Tons.*	*Tons.*		*Tons.*	
1899	1,489,708	.....	36,253	336,134	372,387	.....	1,862,095	.....
1900	1,287,582	.....	32,905	489,385	552,290	.....	1,809,872	.....
1901	1,534,780	.....	29,548	639,736	669.284	.....	2,204,064	.....
1902	1,567,336	.....	145,514	985,912	1,131,426	.....	2,698,762	.....
1903	1,596,220	.....	173,006	659,178	832,184	.....	2,428,404	.....
1904	1,905,451	$30,775,609	229,833	548,495	778,328	$27,281,302	2,683,779	$58,056,911
1905	2,313,153	26,712,339	210,026	736,779	946,805	31,786,607	3,259,958	58,428,946
1906	2,331,121	26,377,640	226,656	974,317	1,200,973	34,407,991	3,532,094	60,785,631
1907	2,586,964	31,583,804	572,441	1,092,276	1,664,717	45,000,000	4,251,681	76,583,804
1908	2,927,041	27,509,475	586,278	1,102,053	1,688,331	43,000,000	4,615,372	70,509,475

July 1, 1908, balance unexpended		$146,579.90
Amount allotted from appropriation by river and harbor act approved March 3, 1909		100,000.00
Received account of sales		18.55
		246,598.45
June 30, 1909, amount expended during fiscal year:		
For dredge construction	$123,820.48	
For maintenance of improvement	42,949.71	
		166,770.19
July 1, 1909, balance unexpended		79,828.26
July 1, 1909, outstanding liabilities		5,680.49
July 1, 1909, balance available		74,147.77
Amount (estimated) required for completion of existing project		2,498,509.93
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		175,000.00

MOUTH OF COLUMBIA RIVER, OREGON AND WASHINGTON.

Prior to the commencement of the work of constructing the jetty in 1885 there were from one to three channels across the bar, and these channels varied from time to time both in location and depth. The depths were from 19 to 21 feet at low water, while the location shifted through nearly 180° between Cape Disappointment and Point Adams.

For a map of the locality and information regarding conditions before improvement, attention is invited to the Annual Report of the Chief of Engineers for 1886, page 1976 et seq.

The first project was adopted in 1884, and provided for the construction of a low-tide jetty, 4½ miles in length, extending seaward from Point Adams, on the south side of the entrance, and terminating at a point about 3 miles south of Cape Disappointment. It was to be built of rubblestone, with a foundation of brush mattresses. This project was modified in 1893 to provide for raising the jetty to high-tide level, and for building four groins from 500 to 1,000 feet in length on the north side.

The estimated cost was $3,710,000, and the jetty was completed to a length of 4½ miles in 1895, and increased the depth over the bar to 31 feet. The total amount expended on the original project was $1,968,753.14, prior to which $17,500 had been appropriated and expended for survey, etc.

The present project was formulated for the purpose of arresting the shoaling process which commenced soon after the completion of the work, the depth having decreased to about 28 feet in 1899, and the location of the channel having shifted into an unstable position 2 miles north of the 1895 channel. By 1902 the depths had deteriorated to 21 feet at low water.

The first appropriation for a new project was made by the act of June 6, 1900, when $250,000 was appropriated for repairs, etc., pending a report to be made by a board of engineers. The report of this board, which is printed in the Annual Report of the Chief of Engineers for 1903, pages 2275 et seq., constitutes the present project, and provided for extending the jetty seaward a farther distance of about 2½ miles. Dredging was also recommended as a temporary expedient, as well as the construction of a north jetty, should it be

found necessary at some future time, in order to secure the desired depth of 40 feet, with a practicable width.

The estimated cost of the south jetty was $2,260,000; of the north jetty, $1,205,000; of remodeling and operating dredge, $250,000.

The revised estimate, approved April 17, 1909, for a completion of the south jetty was $3,529,300, and is based on a report made by the district officer, recommending that the jetty enrockment be raised to at least mid-tide level, and that its crest be given a width of not less than 25 feet, in order to protect the trestle piling from early destruction by storms and teredo. The increased cost is due to the greater amount of stone required, the increase in cost of materials, and the heavy loss, during construction in previous years, due to destruction of the trestle by winter storms and teredo. In some places the jetty is being built in depths as great as 39 feet, and with 15 feet increase in the width of its crest it becomes at once evident that an enormous increase in the amount of rock is required.

The act of March 3, 1909, contained an item of $200,000 for remodeling and operating the dredge *Chinook*, which was formerly the transport *Grant*, and which has been laid up at the government moorings below Portland, Oreg., for the past four years on account of the unsafe condition of her boilers. It is proposed to install new boilers and cut down her upper work, in order to reduce her displacement and draft. The work is to be done under contract.

There has been expended on the existing project to the end of the fiscal year the sum of $4,564,249.20. The portion derived from miscellaneous sources, account of sales, amounted to $1,428.39.

The operations during the past year have consisted in extending the jetty tramway a total distance of 3,960 feet seaward, and over this distance, except the outer portion, the enrockment was brought up to a height of 5 to 8 feet above mean low tide. The enrockment over about 7,926 feet of previous years' extensions was also widened and brought up to the same general elevation. The stone received under contract and dumped on the jetty during the year amounted to 612 404 tons.

Active operations were suspended from December 31, 1908, to April 13, 1909, during which period the receipt of stone was discontinued on account of inclement weather.

At the close of the year an expert dredge designer had been assigned from the Philadelphia district to the work of preparing plans and specifications for the remodeling of the dredge *Chinook*.

The work has been carried on under continuing contract for the purchase of rock, but there is no balance remaining to be appropriated, as the act of March 4, 1909, provided $250,000, which completed all previous authorizations.

The proportion of the project accomplished to the end of the fiscal year is approximately 58 per cent, based on the revised cost.

The advantage derived from the improvement has been the increase of about 5½ feet depth on the bar since the adoption of the project. This is shown by the survey completed just at the close of the fiscal year. A copy of the map is transmitted with the district officer's report, and by referring to it it will be seen that, aside from an increase in depth in the westerly channel of about 1½ feet during the year, there is a marked tendency, due to the scouring effect, to lessen the distance between deep water on the inside and deep water on the out-

side of the crest, besides a reduction in the total width resulting in a well-defined channel with a least depth of 26½ feet, as against 25 feet the previous year.

The gradual movement of Peacock Spit to the north and west, and the westerly movement of Clatsop Spit, are encouraging exhibits, and indicate the controlling influence of the jetty as it advances.

The variation of the level of water surfaces, due to tides, is about 7.4 feet. The head of navigation for deep-sea vessels crossing the bar is at Portland, 110 miles above the mouth.

The commercial statistics will be found with the report in improving Columbia and Lower Willamette rivers, below Portland, Oreg. (p. 861).

Deepening of the channel over the bar will admit of the use of ships of greater draft and increased carrying capacity, and with larger vessels frequenting the port it is reasonable to suppose that the charter rates on deep-sea tonnage will be reduced, and may also reduce the present rail rates on transcontinental shipments.

The amount estimated as a profitable expenditure for improvement is for the purpose of extending the jetty seaward, with a view to increasing the depths and extending the benefits already attained. The $60,000 estimated for maintenance is for operating the dredge *Chinook*, when the work of remodeling her has been completed.

Reference to former reports will be found on pages 686–687 of the Annual Report of the Chief of Engineers for 1905.

July 1, 1908, balance unexpended	$1,510,123.06
Amount allotted from appropriation by river and harbor act approved March 3, 1909	700,000.00
Amount appropriated by sundry civil act approved March 4, 1909	250,000.00
Received from sales	37.05
	2,460,160.11
June 30, 1909, amount expended during fiscal year, for works of improvement	1,015,810.06
July 1, 1909, balance unexpended	1,444,350.05
July 1, 1909, outstanding liabilities	151,600.00
July 1, 1909, balance available	1,292,750.05
July 1, 1909, amount covered by uncompleted contracts	306,000.00
Amount (estimated) required for completion of existing project [a]	2,013,920.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	1,560,000.00

The House committee in its report says:

An unusually large appropriation is made for work on the jetty at the mouth of the Columbia River. Past experience has clearly shown the folly of inadequate appropriations for this improvement, for which a large and expensive plant must be maintained and operated to full capacity to secure economical results. During the past few years work has been vigorously prosecuted, the trestle and plant are now in fine condition, and the funds herein provided can be expended during the coming year. This is the most important and extensive improvement of this character now in progress in the United States, and with present facilities stone can be placed in the jetty at the rate of 4,000 to 5,000 tons per day. It is expected that the south jetty can be completed within the next three years if adequate provision is made for carrying on the work, and any delay due to failure to provide funds to operate the plant to full capacity will result in enormous losses to the United States.

[a] For south jetty only.

GAUGING WATERS OF COLUMBIA RIVER, OREGON

The object of this gauging is to obtain data for use in connection with the improvement of the river and to supply information to persons interested in its navigation.

The self-registering gauge was established at Astoria in November, 1888, where it was kept in operation up to August, 1899, and then moved to Fort Stevens, where it could be more economically maintained. A river gauge was also established at the mouth of the Willamette River and daily records of the readings kept. In view of the benefit to commerce, the maintenance of these gauges is considered a worthy object.

The amount expended on this work, principally for gauge readers, up to June 30, 1909, was $8,649.94.

July 1, 1908, balance unexpended	$1,470.06
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	120.00
July 1, 1909, balance unexpended	1,350.06
July 1, 1909, outstanding liabilities	10.00
July 1, 1909, balance available	1,340.06
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	1,000.00

COLUMBIA RIVER BETWEEN VANCOUVER, WASHINGTON, AND THE MOUTH OF WILLAMETTE RIVER.

The city of Vancouver, Wash., is on the north bank of the Columbia River, about 103 miles above its mouth, and 5 miles above the junction of the Willamette and Columbia rivers. Originally vessels drawing about 23 feet could ascend the Columbia River to within about 2½ miles of the city, where there was a bar over which there was only about 9 feet at low water. This bar resulted partly from an excess of width in the main river and partly from a diversion of a portion of the waters to the south side of Hayden Island.

The original project, adopted by the act of July 13, 1892, provided for constructing a pile, brush, and rubblestone dike about 3,000 feet in length, from the Oregon shore to the head of Hayden Island opposite Vancouver, in order to stop the flow south of the island during low-water stages, deflect it down the main channel, and scour out the troublesome shoals. This project contemplated a depth of 20 feet or more, but this depth was not realized after the completion of the dike.

The existing project, adopted by act of March 3, 1905, is based on the report of the district officer dated July 22, 1902, approved by the Board of Engineers for Rivers and Harbors, and provided for the maintenance of a channel 20 feet deep at low water and 150 feet wide by dredging. The estimate was $60,000 for original work and $10,000 yearly for maintenance of the channel and dike at the head of Hayden Island.

The total amount expended on the original and modified projects to June 30, 1909, was $143,318.60, of which the sum of $45,786.44 was applied to maintenance.

No work was in progress during the year except that of making a survey of the shoals between the railroad bridge at Vancouver and deep water below the lower end of Hayden Island. The survey was made with a view to redredging the shoals, but a suitable dredge could not be obtained for doing the work.

The completion of the dike at the head of Hayden Island, and revetting the bank to prevent erosion, caused considerable scouring on the shoals below Vancouver, but only increased the depth about 1 foot. Under the modified project for dredging, the channel was dredged in 1905 to the desired width and depth and again redredged in the fall of 1906. The survey made in September, 1908, shows that the channel had shoaled in places to 10 feet or less at low water. The variation of the water surface at Vancouver, due to tidal influence, is about eight-tenths of a foot at low water. The annual summer freshet, due to melting snow in the mountains, rises to a height of about 20 feet above low water. Steamboats drawing 8 feet can navigate the river as far as The Dalles, about 210 miles from its mouth, by passing through the locks at the Cascades.

The deep-sea tonnage is principally lumber, but during the calendar year 1908 no shipments were made from Vancouver.

The Spokane, Portland and Seattle Railway Company has completed during the year their bridge across Columbia River at Vancouver, and have trains running on their new road along the north bank of the Columbia River as far as Kennewick, Wash., making connections at that point with the Northern Pacific Railroad. The maintenance of a 20-foot channel over the shoals below Vancouver will allow of deep-sea vessels loading lumber cargoes at the Vancouver mills and save lighterage charges that would otherwise be necessary.

The amount estimated as a profitable expenditure will be applied to the maintenance of the projected depth and may be considered as an extension of benefits.

July 1, 1908, balance unexpended	$9,986.92
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	14,986.92
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	305.52
July 1, 1909, balance unexpended	14,681.40
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	15,000.00

CANAL AT THE CASCADES, COLUMBIA RIVER, OREGON.

This improvement embraces about 4½ miles of the Columbia River where it passes through the Cascade Mountain Range, and is contracted into a narrow gorge with steep slopes and swift current. A fall of 24 feet at low water in the upper 2,500 feet of the gorge creates a turbulent rapid which effectually bars upstream navigation and renders downstream navigation unsafe. The lower 4 miles of the gorge is swift, and before improvement was unsafe by reason of the obstructing ledges and bowlders.

The original project was for a canal and locks around the falls. It was adopted in 1877 and modified in 1886 and 1888, and included

the improvement of the rapids below the falls to secure a low-water channel of 8 feet. The locks were to be about 462 feet long and 92 feet wide, with a low-water depth of 8 feet over the miter sills.

The existing project is a modification of the original project, and is based on report of the Board of Engineers, printed in the Annual Report of the Chief of Engineers for 1895, page 3571. It provided for utilizing the upper 426 feet of the uncompleted canal above the lock gates as a second lock, and also in raising the protection work of the canal walls as a safeguard against flood water. The estimated cost of the original project was $2,544,545, and the later modification $413,360.

The amount expended on the original and modified projects to the close of the last fiscal year was $3,819,875.63. There has been received on account of sales the total sum of $11,629.48.

No work was done during the fiscal year except to care for the plant and buildings, as sufficient funds for construction work were not available.

The canal and locks were completed and opened to navigation in 1895. There yet remains the building of the land wall of the upper lock, construction of three sets of steps, and completing the paving and grading on the land side of the canal. Provision should also be made for blasting out some obstructive ledges below the locks. About 8 feet can be carried at low water through the locks. An annual rise in the Columbia River takes place in May, June, or July, and usually reaches a stage of 40 feet above low water. The head of navigation for boats passing the locks is Big Eddy, about 4 miles above The Dalles. No logs are rafted through the canal, but logging is carried on extensively between Cascade Locks and The Dalles.

The downriver commerce through the locks consists of wheat, flour, miscellaneous grain, cattle, horses, wool, and country produce. The amount of this commerce was 17,687 tons, valued at approximately $1,060,600. The upriver commerce is principally general merchandise, machinery, and supplies, and during the year amounted to 16,490 tons, valued at approximately $989,400.

This improvement is a factor in regulating freight rates to all points reached by steamers using the canal and locks.

The amount estimated as a profitable expenditure will be applied to blasting out obstructions below the locks and in completing the masonry work. The proposed work is not necessary to make the improvement available, but is essential in order to decrease the volumetric capacity of the upper lock, thus shortening the time of lockage.

Comparative statement of traffic.

Fiscal year ending June 30—	Tons.	Estimated value.	Number of passengers.
1900	17,710	.....	30,629
1901	22,426	.....	34,762
1902	19,710	.....	52,720
1903	36,181	.....	50,821
1904	31,967	.....	76,971
1905	35,166	$2,286,125	64,403
1906	46,884	2,813,040	133,070
1907	53,770	3,226,200	89,239
1908	54,954	3,297,240	86,615
1909	34,168	2,050,000	70,482

July 1, 1908, balance unexpended	$1,489.75
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	735.90
July 1, 1909, balance unexpended	753.85
July 1, 1909, outstanding liabilities	60.00
July 1, 1909, balance available	693.85
Amount (estimated) required for completion of existing project	199,260.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	105,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

COLUMBIA RIVER BETWEEN THE FOOT OF THE DALLES RAPIDS AND THE HEAD OF CELILO FALLS, OREGON AND WASHINGTON.

The object of this improvement is to overcome the obstructions in the 12 miles between the foot of Threemile Rapids and the head of Celilo Falls. There are four principal obstructions: Threemile Rapids, a crooked channel 1,500 feet in length, narrow and obstructed by rocks and currents; Fivemile Rapids (The Dalles) where for 1½ miles the river rushes with great velocity between precipitous walls of basalt 150 to 300 feet apart; Tenmile Rapids, a similar gorge, but only one-half mile in length; Celilo Falls, with a sheer fall of 20 feet. The total fall is about 81 feet at low water and 60 feet at high stages. It can not be navigated at any stage.

The first project was adopted by act of August 18, 1894, and contemplated the construction of a boat railway capable of transporting boats of 600 tons. One hundred thousand dollars was appropriated for purchasing the right of way and beginning construction. The act of June 3, 1896, made an additional appropriation of $150,000. A preliminary examination and survey was authorized by act of June 6, 1900, with a view to the construction of a canal and locks. The report submitted under this act is printed in the Annual Report of the Chief of Engineers for 1901, part 5, page 3502, and proposes the construction of a short canal and locks around The Dalles, or Fivemile Rapids, and another around the falls at Celilo, with intermediate river improvement, at an estimated cost of $3,969,371. The amount expended on previous projects prior to the adoption of the present project was $27,112.83.

The existing project, as adopted by Congress in the act approved March 3, 1905, provides for a continuous canal on the Oregon shore, between the pool above Celilo and the pool below Fivemile Rapids, with open river improvement at Threemile Rapids. As subsequently modified in minor details, the canal will have a depth of 8 feet, width of 65 feet at the bottom, and length of 8½ miles, with 5 locks 300 feet by 45 feet by 7 feet over miter sills, two of which will be located at the lower end of the canal, one at Fivemile Rapids, one at Tenmile Rapids, and one at Celilo Falls. As modified, the estimated cost will be $4,845,000.

The open river work at Threemile Rapids, which was included in the project, has been previously considered completed, but investigations in 1908, based on the complaints of steamboat men, make it apparent that further work will be required in order to furnish a safe channel at least 200 feet in width.

There has been expended on the work at Threemile Rapids approximately $120,000, and it is estimated that the additional work will cost about $45,000, thereby increasing the cost of the Threemile Rapids section by about $15,000. It is believed this increased cost will not necessitate any change in the estimated cost of the project as a whole, on account of the large amount estimated for engineering, etc.

The amount expended on the present project to the end of the fiscal year was $642,355.20, of which $31,279.81 was applied to surveying, preparing plans, etc., before its adoption. There has been received on account of the sale of blueprints the total sum of $39.08.

Under contract let in 1904, and completed in March, 1908, there were removed 50,970 cubic yards of rock from the rocky ledges in the vicinity of Threemile Rapids, in order to give a channel at least 10 feet deep at low water and from 200 to 250 feet wide. Additional work may be necessary at this locality in order to provide a safe channel for steamboats.

Work has been in progress during the year under two contracts, one for about 2,500 feet of canal at the upper end and one for the construction of a second section about 14,000 feet in length immediately below and adjoining the first section. At the close of the year the former contract was nearly completed, and the latter contract is about 35 per cent completed. At the close of the year work under these contracts was entirely suspended, owing to the summer freshet, and can not be resumed again until July or August.

This work has been carried on under continuing contract appropriations, the sundry civil act of March 4, 1909, having appropriated the sum of $164,000, which was the balance of the authorization made by the act of March 2, 1907.

With the completion of the contracts now in force, it might be stated that the project is about 20 per cent completed, but no advantages have been derived from the expenditures, except the benefit furnished by the improvement at Threemile Rapids. The variation of the water surfaces from extreme low water and extreme high water is from 32 to 90 feet at different points. Boats are now operating between Portland and Big Eddy, and between Celilo and Lewiston, 265 miles above Celilo on the Snake River, the cargoes being transported around the obstructions between Big Eddy and Celilo by the State Portage Railroad, thus furnishing water competition to all intermediate points on the river.

The Open River Transportation Company, organized for the purpose of operating boats in connection with the State Portage Railroad, has, during the fiscal year, constructed two steamboats with a carrying capacity of about 250 tons each, and during the calendar year 1908 they report the handling of approximately 4,056 tons of merchandise, farm and mill machinery, wheat, and farm products, valued at approximately $207,685.

The influence of this water transportation has resulted in the reduction of freight rates between competitive railroad points up to Celilo, and as the steamboat service on the upper river is increased a still further reduction is anticipated. The benefits to be derived from the improvement when completed, the country which will be affected, and the probable resources to be developed are all described in House Document No. 228, Fifty-sixth Congress, second session.

The irrigation projects now under way and contemplated should, within a few years, increase the farm products and the resultant traffic to very large quantities.

The amount estimated as a profitable expenditure will be applied to further work under contract, and it is recommended that the work be again placed on a continuing-contract basis, with an authorized expenditure of approximately $1,000,000 per year until the work is completed.

The Spokane, Portland and Seattle Railroad has completed its bridges over the Columbia and Willamette rivers, giving entrance to the city of Portland, and making a new transcontinental line along the north bank of the Columbia, connecting with the Northern Pacific at Kennewick, Wash.

Comparative statement of traffic handled by Oregon State Portage Railway between Big Eddy and Celilo, Oreg.

Calendar year.	Tons.	Estimated value.	Calendar year.	Tons.	Estimated value.
1905	3,058	$185,800	1907	4,600	$185,000
1906	5,414	227,900	1908	4,056	207,685

July 1, 1908, balance unexpended	$666,765.10
Amount appropriated by sundry civil act approved March 4, 1909	164,000.00
Received account sales	24.23
	830,789.33
June 30, 1909, amount expended during fiscal year, for works of improvement	250,218.28
July 1, 1909, balance unexpended	580,571.05
July 1, 1909, outstanding liabilities	38,000.00
July 1, 1909, balance available	542,571.05
July 1, 1909, amount covered by uncompleted contracts	377,173.00
Amount (estimated) required for completion of existing project	3,708,392.64
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	1,000,000.00

COLUMBIA RIVER AND TRIBUTARIES ABOVE CELILO FALLS TO THE MOUTH OF THE SNAKE RIVER, OREGON AND WASHINGTON.

This stretch of river is 124 miles long and can be navigated at favorable stages. It abounds in rapids and shoals, which are obstructed by projecting ledges, isolated bowlders, etc. Before the days of railroads the Columbia River formed the main highway for commerce between the inland empire and tide water, but navigation was always more or less dangerous, and was practically suspended in 1882 on account of the construction of a line of railroad by the Oregon Railroad and Navigation Company, which practically paralleled the south bank and reached as far as Riparia on the Snake River, about 72 miles below Lewiston.

The first project was adopted by act of June 10, 1872, and in 1877 was modified to include the improvement of the Snake River. This project provided for the improvement of the most troublesome rapids by the removal of obstructing reefs and bowlders, and in this work

approximately $120,000 was expended up to the time of the suspension of navigation in 1882.

The existing project is based on the survey authorized by act of March 3, 1905, and was adopted by act of March 2, 1907. It proposes to facilitate navigation by the removal of obstructing bowlders and ledges, and raking the gravel shoals in order to make safe and available the channel that now exists. In 1907 the state legislature of Washington appropriated the sum of $25,000 for expenditure in the vicinity of Umatilla Rapids, in order to expedite the work under the general project.

The amount expended on the present project to the end of the fiscal year under the national appropriation was $83,653.51, and under the appropriation by the State of Washington $25,000.

With the drill scow previously constructed under funds appropriated by the State of Washington the work of blasting out obstructions at Umatilla Rapids was continued when conditions were favorable. The stern-wheel steamboat under construction at the beginning of the year was completed and equipped with drilling apparatus and appliances for raking shoals and put into commission the latter part of November. Work continued until May, when operations were suspended owing to high water. During the year 1,047 cubic yards of rock were removed from Umatilla, Biggs, and Homly rapids, and 537 drags were made at Biggs and Homly rapids.

The work accomplished has resulted in improving the channel through some of the most troublesome shoals, mainly Umatilla and Homly rapids, and has lessened, to some extent, the dangers that previously existed. During the summer months the river is in freshet, and the extreme variation of the water surfaces at that time is about 34 feet above low water. The head of low-water navigation for boats using this portion of the stream is at Asotin, on the Snake River, 269 miles above Celilo, and approximately 473 miles from the sea. On higher stages boats ascend the Snake River as far as Pittsburg Landing, a farther distance of about 70 miles. There is no logging on this stretch of river.

During the previous year there was but one small steamboat operating on the river between Celilo and the mouth of the Snake River. During the past year the Open River Transportation Company constructed two light-draft, powerful steamboats, the *Inland Empire* and *Twin Cities*, and these two boats are now being operated between Celilo and Lewiston in conjunction with steamers between Portland and Big Eddy. The cargoes are broken at Big Eddy and at Celilo and are transported around the obstructions between these two points by the State Portage road.

The freight rates charged by these boats on shipments from Portland, Oreg., to Lewiston, Idaho, are on an average about 20 per cent less than the rates charged for shipments by rail.

The amount estimated as a profitable expenditure for the fiscal year 1911 is to be applied to extending the benefits by continuing the work of removing obstructions. With the new plant now available, and with ample funds to operate it, better results may be expected. It is therefore essential that the whole amount be appropriated.

A description of the early conditions will be found in the Annual Report of the Chief of Engineers for 1877, page 1036, and the report of examination and survey for present project is printed as House Document No. 440, Fifty-ninth Congress, second session.

FEDERAL APPROPRIATION.

July 1, 1908, balance unexpended	$85,948.90
June 30, 1909, amount expended during fiscal year, for works of improvement	49,602.41
July 1, 1909, balance unexpended	36,346.49
July 1, 1909, outstanding liabilities	2,080.00
July 1, 1909, balance available	34,266.49
Amount (estimated) required for completion of existing project	280,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	90,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

STATE APPROPRIATION.

July 1, 1908, balance unexpended	$11,840.34
June 30, 1909, amount expended during fiscal year, for works of improvement	11,840.34

SNAKE RIVER, OREGON, WASHINGTON, AND IDAHO.

The portion of the river under improvement extends from its junction with the Columbia to Pittsburg Landing, a distance of about 216 miles. The upper portion runs through a mountainous country and is much obstructed by gravel shoals, ledges of bed rock, bowlders, and numerous rapids. The country through which the river passes, between Riparia and its mouth, is more open, but navigation is difficult, owing to the swift current and numerous rapids. Some of the channels through the rapids are narrow and crooked, and before improvement were practically impassable at low water, owing to the rocky ledges, gravel shoals, and bowlders. The Snake and Columbia rivers, in early days, formed the natural highway for the traffic between the inland empire and the Pacific coast, and navigation on the Snake River, notwithstanding the difficulties, continued until the completion of the railroad to Riparia in 1882, after which boats abandoned the river below that point.

A detailed description of the river prior to, and during, the early years of improvement will be found in the Annual Report of the Chief of Engineers for 1880, page 2293, and 1891, page 3212.

In 1877 a project was approved for removing reefs and bowlders and for scraping gravel bars in the Columbia and Snake rivers between Celilo, Oreg., and Lewiston, Idaho, a distance of 263 miles, at an estimated cost of $132,000. Since 1882 operations on the Snake River have been confined to the stretch above Riparia. In 1892 the project was extended to include the improvement of the 7 miles of river between Lewiston, Idaho, and Asotin, Wash., and the act of June 13, 1902, further provided for extending the improvement to Pittsburg Landing. The project now provides for completing and maintaining the improvement between Lewiston and Riparia, with a view to obtaining a low water depth of 5 feet, by means of blasting, dredging, raking, and by contraction works, and for general improvement up to Pittsburg Landing. The work between Riparia and Pittsburg Landing is based on surveys made in 1900, 1902, and 1906, between Riparia and Lewiston, between Lewiston and Imnaha River, and between Imnaha River and Pittsburg Landing, at an estimated cost of $23,000, $33,690, and $15,000, respectively.

In 1907 the Washington state legislature appropriated $100,000 for expenditure between Riparia and the mouth. This action was the result of a general disposition to revive navigation below Riparia and utilize the State Portage road, which was built in 1905, around the obstructions in the Columbia between Celilo and Big Eddy. The project of this portion of the river, which was formulated for the special purpose of expending the above-mentioned appropriation, is based on the survey made in 1897, and is a continuation of general open river work.

The amount expended on the original and modified projects to the close of the fiscal year was $262,003.99, under the national appropriation, and $74,164.06 under appropriation made by the State of Washington.

There has been received from miscellaneous sources, on account of sales, $825.70.

Operations during the past year have been carried on by the dredge *Wallowa*, belonging to the United States, and by two drill scows previously constructed under state funds. The dredge *Wallowa* operated both above and below Riparia, the two drill scows being confined to work below Riparia. Owing to severe weather and ice gorges, both drill scows were wrecked in January, one being a total loss, and the other picked up and towed back with little damage. A total of 3,482 cubic yards of rock were removed from the different reefs and rapids below Riparia, and 1,485 tons of stone were placed in the dam at Slaughterhouse Rapids, just above Lewiston.

The work done has resulted in providing a low-water channel between Lewiston and Riparia of about 40 inches, in greatly improving the conditions above the latter point, and in making a safer and more available channel below Riparia for all except extreme low stages.

The Snake River is in freshet during the summer months from melting snow in the mountains, and during these freshets the variation of the water levels is usually about 20 feet. The head of navigation, during proper stages, is at Pittsburg Landing, about 216 miles above the mouth, but only intermittent trips are made to that point, regular traffic being carried on only as far up as Lewiston. There is no logging or rafting on the Snake River, but logs are floated down the Clearwater River to the mills near Lewiston.

The Open River Transportation Company, a corporation organized for the purpose of navigating the river, is now operating a line of boats between Portland, Oreg., and Big Eddy, and have constructed two powerful, light-draft boats, the *Inland Empire* and *Twin Cities*, for use on the upper river. These latter boats run between Lewiston and Celilo, and exchange cargoes with the lower river boats by means of the State Portage road between Celilo and Big Eddy.

The Oregon Railroad and Navigation Company, which in former years operated boats between Lewiston and Riparia, partially abandoned the use of the river on completion of their railroad along the north bank to Lewiston during the past year, but owing to the keen competition set up by the new line of boats they are again operating.

The commerce transported on the Snake River during the fiscal year amounted to 46,325 tons, and consisted principally of farm and mill machinery, grain, fruit, and general merchandise, valued at, approximately, $1,251,335.

The reestablishment of water transportation between Lewiston and Portland has resulted in a reduction in freight rates of about 20 per cent between those points.

The amount estimated as a profitable expenditure for the next fiscal year will be applied to the removal of obstructions, for maintenance and improvement, and the proposed work is essential in order to make the improvement available.

For earlier reports on examinations and surveys, attention is invited to Annual Reports of the Chief of Engineers for 1877, page 1036; 1882, page 2716; and 1885, page 2440. Reports of surveys covering several sections now under improvement, with estimates of cost, will be found in the annual reports as follows: Between Riparia and the mouth, 1898, page 3013; between Riparia and Lewiston, 1901, page 3525; between Lewiston and the mouth of Imnaha River, 1903, page 2246; between Imnaha River and Pittsburg Landing, 1906, page 1986.

Comparative statement of traffic carried on Columbia River above Celilo and on Snake River during year ending December 31, 1908.

Calendar year.	Columbia River above Celilo.	Snake River.	Total.	Estimated value.
	Tons.	*Tons.*	*Tons.*	
1899			45,654	
1900			35,920	
1901			36,723	
1902			37,824	
1903			44,379	
1904			43,547	$1,798,677
1905			28,380	1,191,960
1906			71,556	2,671,882
1907	7,776	39,228	47,004	1,880,300
1908	1,349	46,325	47,674	1,296,750

FEDERAL APPROPRIATION.

July 1, 1908, balance unexpended	$4,258.38
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	9,258.38
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	3,892.26
July 1, 1909, balance unexpended	5,366.12
July 1, 1909, outstanding liabilities	278.00
July 1, 1909, balance available	5,088.12
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	15,000.00

STATE APPROPRIATION.

July 1, 1908, balance unexpended	$52,622.69
June 30, 1909, amount expended during fiscal year, for works of improvement	26,786.75
July 1, 1909, balance unexpended	25,835.94
July 1, 1909, outstanding liabilities	337.00
July 1, 1909, balance available	25,498.94

BELLINGHAM HARBOR, WASHINGTON.

Following is the report of the Board of Engineers on a recent survey, in which the Chief of Engineers concurs, printed in House Document No. 1161, Sixtieth Congress, second session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., June 8, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

In the report on preliminary examination it was explained that in 1905 the Whatcom Creek waterway was dredged by the United States to a depth of 12 feet, but that this depth has been found insufficient for the needs of the port.

The district officer suggests as a suitable improvement the dredging of the waterway to provide an actual depth of 26 feet in the outer portion of the waterway, and an actual depth of 18 feet in the inner portion, which he estimates will cost $92,250. He believes that the commerce of the locality is of sufficient importance to justify the expenditure required on condition that the local interests do all necessary bulkheading at their own expense and construct a wharf along the waterway, and he believes that the expenditure of any funds appropriated should be made conditional upon satisfactory provision being made for their construction prior to the commencement of actual dredging. The division engineer also suggests certain conditions, with a view to promoting the efficiency of the harbor and equitably apportioning the expense.

The reclamation of the tidal flats adjoining the waterway and the construction of suitable wharves are desirable adjuncts to the proposed improvement and will greatly add to the value of the improvement. The deposition of the dredged material behind suitable bulkheads on either side of the proposed waterway will, to a limited extent raise the adjoining areas and render them more available for terminal and other uses and is the logical and natural place for the deposition of this material, and it is probable that if the material is so deposited the cost of the work will be much less than with any other method of disposal. The reclamation of the land in this manner will largely increase its value to the individual owners and also to the city, and it is eminently proper, therefore, that the city or the individual owners, or both, should bear a just proportion of the expense, and that the adoption of the improvement should be made conditional upon the United States being given the right to deposit the dredged material upon the adjacent areas, as will be for the best interests of the work. It is further considered proper that the individual property owners or the city should do the necessary bulkheading, and that they should construct the proposed wharves along the waterway, and that these wharves should be made available for the free use of commerce. Under these conditions the Board agrees with the district officer and the division engineer in considering the project a worthy one, and it therefore recommends the approval of the project presented by the district officer on the following conditions:

That the United States shall be under no expense for the construction of bulkheads, groins, or filling, and that before any of the appropriation shall be available for expenditure, or any contract let for the improvement, satisfactory provision shall be made, to be approved by the Secretary of War, that in the prosecution and completion of the work of dredging said channel the cost and charges for the construction of the necessary bulkheads and groins, or for necessary filling, will be furnished upon demand of the United States engineer in charge, and the design and location of said bulkheads and groins shall be subject to his supervision; and that the United States shall have the right to deposit upon the lands adjacent to the waterway all the material excavated therefrom, and that all filling which may be done by other parties shall be in accordance with plans and specifications to be approved by the Secretary of War.

For the Board.

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

The commerce of the port is considerable, and the records show an increase from 87,118 tons in 1902 to 341,299 tons in 1906, the value of which is given as $9,990,864.

GRAYS HARBOR (INNER PORTION) BETWEEN ABERDEEN AND THE ENTRANCE TO SAID HARBOR, AND CHEHALIS RIVER, WASHINGTON.

There are two main channels traversing the inner or eastern part of Grays Harbor from east to west—the North and South channels. There was also formerly a Middle channel connecting the North and South channels. The South channel is shoal and is but little used. The North channel is used by all ocean-going vessels entering the harbor. There are two shoals in the North channel, one about 2½ miles below Hoquiam and one between Hoquiam and Aberdeen. The ruling depth over these shoals was originally 8 feet at mean low water. The channel widths were ample.

The Chehalis River is in the southwestern part of Washington. It has a westerly course and empties into Grays Harbor Bay at its eastern extremity.

From the mouth to Montesano, 15 miles, there is about 10 feet of water at high tide. From Montesano to Elma, 16 miles, there is generally sufficient water for light-draft boats. There is practically no navigation above Elma, and no regular boats go above Montesano. The river is used extensively for floating saw logs.

The original project for the inner harbor, adopted by Congress July 13, 1892, provided for the construction of piles, brush, and stone dikes to partly close up the South and Middle channels and concentrate the flow of water in the North channel, thereby increasing the depth of water by scour. The shoals above and below Hoquiam were to be dredged to a depth of 16 feet at half tide.

The amount expended prior to operations under existing project was $93,999.06.

The original project for Chehalis River, adopted by Congress August 2, 1882, contemplated the removal of snags and other obstructions which may accumulate in the portion of the river regularly used by boats. The estimated cost is indefinite.

The existing project adopted by the river and harbor act of March 2, 1907, provides for a channel 200 feet wide and 18 feet deep at mean lower low water from Cosmopolis to deep water below Hoquiam, and removing snags from the Chehalis River, at an estimated cost of $187,500. This plan is printed in House Document No. 507, Fifty-ninth Congress, first session.

Report on examination and survey of the Chehalis River, made in compliance with the river and harbor act of March 2, 1907, was published in House Document No. 1125, Sixtieth Congress, second session.

To June 30, 1909, $252,864.77 had been expended under the above project for Grays Harbor, inner portion, of which $20,440.38 was applied to maintenance of dikes and for surveys.

Two middle dikes and a protecting sill, with an aggregate length of 13,986 feet, had been constructed in the inner harbor, and six high-tide dikes, with an aggregate length of 1,476 feet, had been constructed in the Chehalis River. The depth of water over the shoals in the inner harbor was increased about 2 feet and over the shoals in the Chehalis River from 2½ to 7 feet, but these depths were not permanent.

The dredging work under the existing project was done by contract. It was commenced December 16, 1907, and the total quantity of

material removed was 1,200,000 cubic yards. The quantity removed during the fiscal year was 300,000 cubic yards. The contract was completed on August 24, 1908.

The project was partially completed with the funds available, but the channel secured is not of the full width contemplated by the act of March 2, 1907. It is expected to obtain the full project width by operating the new dredge *Oregon* with funds provided by the river and harbor act approved March 3, 1909.

The maximum draft that could be carried June 30, 1909, over the shoals below Aberdeen at mean lower low water was about 18 feet.

The maximum draft that could be carried June 30, 1907, at mean low water at Montesano was about 5½ feet.

The tidal variation is 8½ feet in the inner harbor and 7 feet in the Chehalis River.

The commerce benefited by this improvement consists very largely of floating and towing logs and carrying lumber in sailing vessels and steam schooners.

The appropriation recommended will be applied to maintenance of existing works.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1898	2,730	$293,610	1904	5,637	$248,825
1899	2,232	352,316	1905	17,195	650,428
1900	4,376	132,157	1906	11,567	773,574
1901	5,706	200,264	1907	9,414	687,703
1902	3,529	157,532	1908	38,004	595,718
1903	4,972	139,150			

No definite information of reduction of freight rates on account of the improvement has been received.

July 1, 1908, balance unexpended	$92,404.73
Amount allotted from appropriation by river and harbor act approved March 3, 1909	25,000.00
Received from sales	27.00
	117,431.73
June 30, 1909, amount expended during fiscal year, for works of improvement	88,268.56
July, 1, 1909, balance unexpended	29,163.17
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	16,000.00

Report on a recent survey of Chehalis River is printed in House Document No. 1125, Sixtieth Congress, second session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., June 8, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

The act of March 2, 1907, in the item appropriating funds for the improvement of Grays Harbor, inner portion, and Chehalis River, directed a survey and estimate, with a view to the improvement of Chehalis River up to Montesano by the removal of bars. The within report of the district officer on this subject contains a statement of the commerce of the locality which will be benefited by the improvement con-

templated by the act, and an estimate of cost, amounting to $36,000, for dredging a channel 6 feet deep at mean low water up to Montesano, in addition to which certain dike work will be required at an estimated cost of $6,000, which, with suitable allowance for contingencies, makes the total cost of the improvement approximately $50,000. The district officer believes the improvement of the stream to this extent is justified by the present and prospective commerce to be benefited, and in this opinion the division engineer concurs, but believes that the dredging, if authorized, should be done by the hydraulic dredge now under construction at Portland for use on the coast harbors of Oregon and Washington.

An examination of the Chehalis River to Montesano was made in 1905, complying with the requirements of the river and harbor act of that year, and the report on that examination came before the Board of Engineers for Rivers and Harbors for review in accordance with law. In connection with its investigations the Board held a public hearing in regard to this subject, and carefully considered the desires of local interests as expressed in a written statement from the Montesano committee appointed to explain this matter to the Board. In that statement it was requested that the Government provide a channel 12 feet deep at mean low water, which, in view of the comparatively small commerce to be benefited and the probable large expense of the work, the Board was constrained to report as being inadvisable.

The district officer states that local interests now desire a channel 6 feet deep at mean low water, as contemplated by his estimate. Such a channel, which would give 14½ feet at average high water, would provide facilities sufficient to permit the use of light-draft ocean-going vessels at favorable tides. The estimated cost of the improvement is not excessive, considering the value which it will be to present and prospective commerce, and the Board concurs with the district officer and the division engineer that an improvement to the extent contemplated by the district officer is advisable. While it would appear advisable in the interests of economy to use a government dredge if one becomes available, the Board does not believe that the authorization of the work should be made contingent upon this method.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

HAMMERSLEY INLET, PUGET SOUND, WASHINGTON.

Report on a recent survey is printed in House Document No. 213, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 2, 1909.

SIR: I have the honor to submit herewith, for transmission to Congress, reports of May 3 and October 22, 1909, with map, by Maj. C. W. Kutz, Corps of Engineers, upon preliminary examination and survey, respectively, of Hammersley Inlet, Puget Sound, Washington, authorized by the river and harbor act of March 3, 1909.

A plan for improvement to provide a channel 150 feet wide and 9 feet deep from the entrance of the inlet up to Shelton by dredging, at an estimated first cost of $9,000, is presented. Little or no maintenance will probably be required.

I concur in the opinion of the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors that the locality is worthy of improvement by the General Government as proposed.

No question of terminal facilities, development of water power, or similar subjects are involved in the consideration of this project.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

The mouth of this inlet lies about 10 miles north of Olympia. From its mouth to Shelton, distant about 7 miles, the inlet is narrow, and has very much the appearance of a river. Above Shelton the inlet bends sharply to the right and rear, and becomes considerably wider, but the only part that is used as a commercial waterway is the reach between Shelton and the mouth. For the greater part

of this distance there is from 10 to 14 feet of water, but there are three shoals near the mouth with from 4½ to 6 feet of water over them at low tide.

The only town on the inlet is Shelton, which has a population of about 1,500. From Shelton a logging road, with 32 miles of main line, extends westward and northward.

The principal commerce of the inlet consists in the towing of logs brought down by the railroad and dumped into tide water at Shelton. Here they are formed into rafts and towed to various mills on Puget Sound. It is estimated that 200 rafts were towed out of the inlet during 1908. The tugs engaged in this traffic draw from 8 to 14 feet of water, and consequently can enter the inlet only when the tide is favorable.

Approximately 115,000,000 feet of logs were towed out in 1908, the value of which was from $8 to $9 a thousand. The logs are sold by the Logging Company at Shelton, towing being done by the mills, so that the improvement will not be solely in the interest of the Logging Company.

The Shelton Transportation Company operates a boat between Shelton and Olympia, making two round trips each day. It is stated that during 1908 this boat carried 27,000 passengers and 7,000 tons of freight.

OLYMPIA HARBOR, WASHINGTON.

The following is printed in Rivers and Harbors Committee Document No. 5, Sixty-first Congress, second session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., March 9, 1908.

GENERAL: 1. Complying with the following resolution—

"*Resolved by the Committee on Rivers and Harbors of the House of Representatives*, That the Board of Engineers on Rivers and Harbors, created by the act of June thirteenth, nineteen hundred and two, be, and it is hereby, requested to further consider the examinations and surveys for the improvement of the following-named rivers and harbors, and to report its conclusions thereon: * * * Olympia Harbor, Washington, * * *"

the Board has the honor to submit the following:

2. The report referred to in the resolution is published as House Document No. 405, Fifty-ninth Congress, first session, and was made in compliance with the river and harbor act of March 3, 1905. It proposes the construction of a channel on the west side of the harbor, paralleling the west harbor line, extending from deep water to a point opposite the Olympia Manufacturing Company's plant, where a turning basin, 800 feet long and 400 feet wide, was proposed, all to a depth of 12 feet below mean lower low water, at a cost of $58,000 and $1,160 annually for maintenance. The purpose of the proposed improvement was to render it possible for vessels to reach manufacturing industries located along the western shore of the harbor.

3. The report of the district officer on the survey of the harbor indicated a considerable decline in the water-borne commerce of the port in recent years, and the latest official census report showed a loss in population in the preceding ten years. In view of these facts, and for other reasons stated in its report reviewing that of the district officer, the Board concluded that Olympia Harbor was not worthy of further development than was contemplated by the existing project.

4. With a view to carrying out the purposes of the resolution, and becoming personally informed of the physical and commercial conditions at this port, the Board, on January 24, 1908, through a committee of its members, made an inspection of the harbor and of the city of Olympia, and held a public hearing with reference to the questions involved. While no census of the population has been taken by actual count since 1900, indirect evidence offered at the public hearing, such as a large increase in the number of incandescent lights in use in residences, an expansion in post-office receipts, a material increase in street-car receipts, also in the number and

and the amount of personal bank accounts, and in the school census, appears to substantiate the claims of interested persons that the population of Olympia has considerably increased since the last official census was taken.

5. The records of the commerce of the port show a material increase both in amount and value since the former report. The tonnage was then reported as 22,899 tons, valued at $675,540, while for 1906 it amounted to 82,295 tons, valued at $3,407,167, an increase of 260 per cent in quantity and 404 per cent in value. If the estimate for 1904 be rejected as erroneous on account of incomplete returns, and the record of the preceding or succeeding year be taken as a basis of comparison, there is still a very substantial increase shown.

6. The principal development in the commercial situation at this harbor since the original project was laid out has been the establishment of a number of industrial plants on the west shore of the harbor, this site being chosen on account of the possibility of both rail and water connections. These interests now represent a large proportion of the commerce of the port, and they are handicapped by not being able to reach the dredged channel on account of shallow water between the harbor line in front of their plants and the present channel.

7. It was stated at the public hearing that wharves or piers would at once be built out to the harbor line if the desired channel were dredged, and that vessels could then load directly from the plants, by which arrangement lighterage would be saved and the coastwise trade, which has come into existence since the adoption of the project on the east side of the harbor, would expand into a very considerable commerce.

8. The conditions existing at the present time render the locality much more worthy of favorable recognition than it was at the time of the former report, and the Board is now of the opinion that the cost of the proposed improvement, $58,000, is not unreasonable when compared with the present and prospective commerce of the port. It recommends, therefore, the adoption of the project outlined in House Document No. 405, Fifty-ninth Congress, first session, with the further recommendation, in view of the benefits that will accrue to riparian owners, that local interests construct at their own expense any bulkheads found necessary by the district officer in the proper execution of the work.

For the Board:
Very respectfully,

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. Army,
Washington, D. C.

COLUMBIA RIVER BETWEEN WENATCHEE AND BRIDGEPORT, WASHINGTON.

The Columbia River between Wenatchee and Bridgeport, Wash., is about 80 miles in length, has sufficient depth for all purposes of navigation, and the only difficulties in the way of navigation are the swift currents and rocks and reefs which occupy the channels.

The project adopted by the river and harbor act approved August 18, 1894, for the improvement of the Columbia River between the head of Rock Island Rapids and the foot of Foster Creek Rapids included the part of the river between Wenatchee and Bridgeport, and the amount expended on the original project was $8,005.20.

The existing project, adopted by act of March 2, 1907, contemplates the improvement of the river between Wenatchee and Bridgeport by the removal of rocks, bowlders, etc., and the construction of dikes and wing dams, at an estimated cost of $42,000.

Owing to the great range of the river between high and low water and the short period at which it is at a stage low enough for practicable operations, it was not possible to take up more than one of the several works embraced in the project.

During the past year Chelan rock was drilled but not blasted. The volume of rock to be removed is about 2,000 cubic yards and the blasting will be done at the next low-water period.

The amount expended to June 30, 1909, was $32,288.37, of which $150 was for maintenance and inspections.

The project is about 60 per cent completed.

The variation in water surface is about 20 feet.

The estimates originally submitted for this work were inadequate. At Methow Rapids the cost exceeded the estimate by nearly $15,000, and at Chelan the cost, when completed, will be about $9,000 in excess of the estimate.

To carry out the original project an additional appropriation of $25,000 will be required.

So far as known this improvement has not caused any reduction in freight rates.

Exports and imports.

Calendar year.	Tons.	Value.
1904	24,506	$2,251,590
1905	39,827	3,169,060
1906	53,260	3,901,360
1907	42,126	3,091,550
1908	54,527	3,368,119

Report on examination and survey of the part of the river between Wenatchee and Bridgeport was published in House Document No. 440, Fifty-ninth Congress, second session, and report on examination and survey of the part of the river between Bridgeport and Kettle Falls was published in House Document No. 16, Sixtieth Congress, second session.

July 1, 1908, balance unexpended	$19,930.69
June 30, 1909, amount expended during fiscal year, for works of improvement	10,219.06
July 1, 1909, balance unexpended	9,711.63
July 1, 1909, outstanding liabilities	383.50
July 1, 1909, balance available	9,328.13
Amount (estimated) required for completion of existing project	25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	25,000.00

COLUMBIA RIVER FROM BRIDGEPORT TO KETTLE FALLS, WASHINGTON.

Following is an extract from Rivers and Harbors Committee Document No. 16, Sixtieth Congress, second session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., April 20, 1908.

GENERAL: 1. The Board has received by your reference the following resolution of the Committee on Rivers and Harbors of the House of Representatives:

"*Resolved by the Committee on Rivers and Harbors of the House of Representatives*, That the Board of Engineers for Rivers and Harbors created by the act of June 13, 1902, be, and it is hereby, requested to further consider the examinations and surveys for the improvement of the following-named rivers and harbors, and to report its conclusions thereon:

* * * * * * *

"5. Columbia River from Bridgeport to Kettle Falls, Washington, with a view to open-channel navigation to Kettle Falls."

2. The river and harbor act of March 3, 1905, contained a provision for a "general survey or examination of Columbia River, * * * including that portion between Wenatchee and Kettle Falls, with a view to open-channel work." Based upon the information obtained by the preliminary examination, a survey was made of the stretch between Wenatchee and Bridgeport, and later the improvement of this reach was recommended. No survey was made of the stretch of river above Bridgeport, as it appeared at that time that the demands of commerce and navigation were not commensurate with the probable cost of improvement. It appears that since the date of the Board's report there has been a very rapid development of the country along the upper Columbia, particularly over that portion lying between Bridgeport and Kettle Falls, and the present investigation is with a view to reporting upon the advisability of improving this stretch in the light of these recent developments.

3. It being evident, from early inquiries made by the Board, that this subject was worthy of the fullest investigation, and that it was advisable to have a better knowledge of the character and extent of the obstructions to navigation and the cost of their removal before final recommendations were submitted, the Board recommended that a survey be made. This has been done, and the report of the district officer thereon, to which attention is respectfully invited, is inclosed herewith. He describes very fully the physical and commercial conditions which are to be considered in connection with the improvement of this stretch of river.

4. It is reported that the expansion of the wheat and fruit growing industries has been very marked and that the boats now plying the river are unable to handle the product. From the various sources of information the district officer has arrived at the conclusion that by the time the river can be improved the commerce ready for transportation will amount to as much as 200,000 tons per annum. He states that there is small prospect for railroad facilities in this section of country and that immediate use will be made of the stream if rendered navigable. The principal obstructions to navigation were found to be certain rapids, caused by large bowlders and solid rock ledges.

5. The district officer states that while the permanent improvement of the river will require locks, the time has not yet arrived when this method would be justified, but that the removal of the worst obstructions will make the rapids reasonably safe and the river susceptible of navigation. He reports 26 localities where work will be required. The plan of improvement contemplates the removal of large loose rock along the shores, the excavation to a depth of 7 feet of certain rocks exposed at low water, and the removal to the same depth of some submerged rock. He estimates the cost of this work, including contingencies, at $100,000. Owing to the absence of suitable plant for carrying on such work, the district officer is of the opinion that one should be provided and owned by the Government, consisting of a light-draft towboat, quarter boats, drill scows, and other necessary plant, the cost of which he places at $75,000, making the total appropriation required for the improvement which he recommends $175,000. The division engineer concurs in the recommendations of the district officer.

6. The Board believes that the method for carrying on the work as suggested by the district officer is the best that can be followed in this isolated region. The work will be of such a character that it will be very difficult to measure and let by contract. Furthermore, although certain places can now be named where work is evidently needed, yet experience in similar cases elsewhere indicates that as this work is progressively completed the necessity for operations at other points will become apparent, and it is therefore especially desirable that the Government shall own the plant and be at liberty to use it wherever necessary, under appropriations to be made for general improvement or maintenance.

7. Based on all information now available, the board reports that in its opinion the present and prospective commerce of this section of country is of sufficient extent and importance to justify the United States in undertaking the improvement of the Columbia River between Bridgeport and Kettle Falls, as suggested by the district officer, at an estimated first cost of $175,000, and it recommends that this amount be appropriated in one sum. The operation of the plant to be thus provided should be extended even beyond the sum named for such operation if this be found necessary in the course of the work.

For the board:

Very respectfully,

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. Army, Washington, D. C.

COWLITZ AND LEWIS RIVERS, WASHINGTON.

(*a*) *Cowlitz River.*—The Cowlitz River rises in the Cascade Range, flows in a southerly direction, and empties into the Columbia 64 miles above its mouth and about 45 miles below Portland. Prior to improvement the ruling depth to Toledo, 40 miles above the mouth, was about 14 inches at low water, and the channel was crooked and obstructed by sand bars, snags, and drift.

The original and present project was adopted by the act of June 14, 1880, and provided for the removal of sand bars and other obstructions to a point about 50 miles above the mouth, at a cost of $5,000 and an annual expenditure thereafter of $2,000 for maintenance.

The expenditures to the close of the fiscal year amounted to $51,528.01, of which $46,529.01 has been applied to maintenance.

Operations during the past fiscal year consisted in clearing the channel of some troublesome snags. The work was done in April, by small boat and crew, by blasting.

The project, except as to maintenance, has been completed. The work done in previous years has resulted in furnishing a comparatively easy channel for boats running to Portland. The maximum draft that can be carried over the shoalest places at the close of the year is approximately 14 to 16 inches at low water. The usual variations of the level of water surfaces, due to tide, range from 4 feet at the mouth to zero 9 miles up the stream. The extreme variation on account of freshets is about 22 feet, except at the mouth, where the country is open, allowing the water to spread over a large area. The head of navigation for light-draft boats on the higher stages is 10 miles above Toledo, or about 50 miles from the mouth. Large quantities of logs are annually floated down the river from the headwaters, for a distance of 25 to 90 miles.

Kelso, 4½ miles from the mouth, and having a population of about 1,500 people, is the principal town of the valley, and is the center of a large lumber and shingle industry. Kelso and Castle Rock, another small town about 20 miles from the mouth, are both on the main line of the Northern Pacific Railway, and while some lumber products are shipped by rail, the farm products are usually handled by the river boats and marketed at Portland. The river is therefore a great factor in regulating freight rates from these points to competing points on the river. The traffic consists of lumber and farm products and general merchandise, of which 53,309 tons were handled during the calendar year 1908, valued at $1,934,982.

The amount estimated as a profitable expenditure is required to maintain the channel and remove the obstructions which are brought down the stream during freshet periods. Annual work is necessary to make the improvement available.

References to former reports will be found on page 689 of the Annual Report for 1905. Report of survey made in October, 1908, with estimate of cost of improvement, from the mouth to Castle Rock, is printed in House Document No. 1167, Sixtieth Congress, second session.

Comparative statement of traffic.

Calendar year.	Tons.	Estimated value.	Passengers.
			Number.
1899	26,511		
1900	17,279		
1901	14,211		
1902	15,932		
1903	41,515		
1904	26,120	$1,069,020	6,875
1905	46,646	1,494,260	6,000
1906	56,109	2,055,460	1,117
1907	66,424	3,390,000	750
1908	53,309	1,934,982	

This statement does not include 187,734,187 feet b. m. (375,468 tons) of logs sent down this stream in 1908, having an estimated value of $1,126,404.

(*b*) *Lewis River.*—The Lewis River rises in the Cascade Range, flows in a westerly direction, and empties into the Columbia River about 14 miles below the mouth of the Willamette and 25 miles below Portland. At a distance about 3¾ miles from its mouth the river separates into two branches, known as the North Fork and the East Fork, of which the North Fork is the larger stream. The lower reaches are affected by the tides and also by back water from the Columbia. Originally the channels were obstructed by snags, overhanging trees, and occasional shoals, but were navigable for small light-draft boats at proper stages to La Center on the East Fork and Woodland on the North Fork.

The original project was adopted in 1897. (See Annual Report of the Chief of Engineers for 1897, p. 3473.) It provided for the removal of snags and obstructions, dike construction and dredging, with a view to securing a depth of 6 feet in the main river and 4 feet on the East Fork to La Center. The estimated cost was $20,460.

The present project is the same as the original one, except that the improvement of the North Fork was included in the river and harbor act of June 13, 1902, for which no estimate of cost has been made.

There has been expended on the original and modified project to the close of the fiscal year the sum of $21,114.62.

Operations during the year were confined to snagging and clearing overhanging trees from the banks. The work was done in January, and a total of 132 snags were removed from the channel and 169 trees cut from the banks. This work was done by the U. S. snagboat *Mathloma* after completion of operations on the upper Willamette River.

The work done in previous years has resulted in a good channel for boats plying between Portland and Lewis River points. The maximum draft that can be carried at normal stages to the forks is about 4 feet, and on the two forks to the head of navigation about 1 foot.

The head of navigation on the North Fork has heretofore been considered at Woodland, but at the present time a small boat is making three regular trips per week to Runyon, about 23 miles above Woodland.

The variation of the water surfaces, due to tides, is from 2 feet at the mouth to 1½ feet at La Center, while at Woodland the tide has no effect. The winter freshets vary from 15 to 20 feet in height, except near the mouth, where the water spreads out over a large area,

and the conditions are such that regular boats from Portland reach La Center during about three months of each year and Woodland about nine months. Logs are floated down this stream for a distance of 20 to 45 miles above the mouth.

The Northern Pacific Railway, between Portland and Puget Sound, crosses the river at Woodland, but the river carries the greater part of the commerce from the valley, owing to the cheaper rates of transportation and the better facilities for handling traffic by water. The commerce consists principally of lumber, farm products, and general supplies, and during the calendar year 1908 amounted to 17,771 tons, valued at approximately $1,112,840. This does not include large quantities of logs floated down the stream.

The amount estimated as a profitable expenditure is required for dredging and snagging. A large amount of sediment and numerous snags are brought down by the freshets, which necessitates additional work each year to maintain the channel and make it available for boats of light draft.

Comparative statement of traffic.

Calendar year.	Tons.	Estimated value.	Passengers.
			Number.
1899	6,549	.....	12,351
1900	12,638	.....	14,129
1901	17,277	.....	15,532
1902	13,831	.....	13,096
1903	29,033	.....	13,058
1904	27,245	$334,492	12,885
1905	26,554	1,067,733	29,026
1906	19,024	960,120	16,614
1907	20,140	1,179,117	13,869
1908	17,771	1,112,840	13,880

This statement does not include 49,451,021 feet b. m. (98,902 tons) of logs sent down this stream in 1908, having an estimated value of $296,706.

CONSOLIDATED.

July 1, 1908, balance unexpended	$4,712.09
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,854.72
July 1, 1909, balance unexpended	2,857.37
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	7,500.00

The following is from House Document No. 1167, Sixtieth Congress, second session.

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., October 26, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

In the report on preliminary examination of Cowlitz River it was stated that some of the interests concerned desired a channel 8 to 10 feet deep from the mouth to Kelso, while others advocated a lesser channel, suitable for light-draft steamboats. The improvement desired above Kelso was stated to be a channel 4 feet deep for a distance of about 4 miles, and thence 30 inches deep for a further distance of 10 miles to Castlerock.

The district officer submits two projects for improvement. Project No. 1 provides for an 8-foot channel 100 feet wide from the mouth to Kelso, at an estimated cost of $52,500; a 4-foot channel 50 feet wide from Kelso to Ostrander, at an estimated cost of $4,800; and a channel 30 inches deep thence to Castlerock, at an estimated cost of

$3,000, the total cost of this project, including allowance for engineering and contingencies, being $66,330. Project No. 2 contemplates a depth of 4 feet below Kelso, being otherwise identical with project No. 1. Its total cost is placed at $22,000. Having in mind the commercial interests involved and the effect of the improvement on freight rates, the district officer is of the opinion that the stream is worthy of further improvement by the United States to the extent outlined in project No. 2.

This stream is one on which extensive log rafting interferes to some extent with general navigation. While small light-draft steamers should be able to operate successfully under these conditions, the navigation of larger steamers, such as would require a depth of 8 feet, as proposed below Kelso, would be attended with more or less difficulty and danger. It is clear to the Board that under existing conditions the lesser project submitted will adequately serve the necessities of commerce and should exercise a beneficial influence upon freight rates. It therefore concurs with the district officer in recommending the adoption of project No. 2, at an estimated cost of $22,000, with $4,000 per annum for maintenance.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

The commerce of Kelso now amounts to about 128,560 tons per annum, while that of Castlerock amounts to 221,850 tons, a total of 350,410 tons received and shipped from these two points alone. While the larger proportion of this tonnage consists of lumber and its products, there is, nevertheless, a substantial tonnage in coal, farm products, and miscellaneous incoming freight. Although navigation in the past has been inefficient and intermittent, the table of freight rates prepared by the district officer clearly indicates the important service of the waterway in controlling railroad rates within the area of its influence.

The following is from House Document No. 404, Sixty-first Congress, second session:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 15, 1909.

SIR: I have the honor to submit herewith for transmission to Congress reports dated September 28 and November 1, 1909, by Maj. J. B. Cavanaugh, Corps of Engineers, on preliminary examination and survey, respectively, of Cowlitz River, Washington, from Castlerock to the head of navigation, authorized by the river and harbor act of March 3, 1909.

Under authority of the river and harbor act of March 2, 1907, the Cowlitz River was examined up to Castlerock and a report submitted to Congress recommending a channel 50 feet wide and 2½ feet deep immediately below Castlerock. The present investigation is with a view of improvement from Castlerock to the head of navigation, which appears to be at Toledo, about 36 miles above the mouth, or 16 miles above Castlerock, and to secure an improvement on this stretch comparable with that below will require the formation and maintenance of a channel not less than 40 feet wide and 2½ feet deep at low water.

The obstructions consist of snags and gravel bars, over which the limiting depths at low water are from 1 to 2 feet, and to provide the desired low-water depth there will be required dredging, snagging, and the construction of a limited number of regulating works, amounting to $9,600, with $2,000 annually for maintenance.

I concur with the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors in the opinion that Cowlitz River from Castlerock to Toledo, when taken in connection with the project for the lower portion of the river, is worthy of being undertaken by the General Government.

No question of terminal facilities, development of water power, or similar subjects not considered in the reports are involved in the consideration of this project.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

It is reported that on this reach above Castlerock there is a boat commerce amounting to 21,634 tons, valued at $1,058,120, and it appears that the country adjacent is developing, and that an increase in commerce can reasonably be expected in the future if better navigation facilities are provided.

GRAYS RIVER, WASHINGTON.

Grays River is a tributary of the Columbia River, emptying into Grays Bay, nearly opposite the town of Astoria, Oreg. It rises in the Coast Range and flows through dense forests until it reaches the lowlands bordering on the Columbia River. It has been navigated for years with difficulty, owing principally to numerous snags and logs and overhanging trees.

The original and present project was adopted by the act of March 2, 1907, which appropriated $2,500 for the purpose of removing the obstructions from the channel and cutting the overhanging trees from the banks. The project for this work was based on a report of the Board of Engineers for Rivers and Harbors, dated October 13, 1906, by which it was proposed to carry the improvement to the head of navigation.

The total amount expended on this work to the close of the last fiscal year was $2,129.47.

Operations during the year were carried on from September 1 to 25, 1908, with a small snagging crew using a gasoline launch. A total of 195 troublesome snags were removed by the use of powder, of which approximately 600 pounds were used. Scraping of the bars between the mouth and the town of Grays River was also carried on by means of a hoisting engine, from May 18 to June 9, and at the close of the fiscal year there was a good, clear, and open channel to the head of navigation.

It may be stated that all of the work contemplated under the project has been completed, and has resulted in furnishing a safe and easier channel for small boats navigating the stream. The maximum draft that can be carried to Grays River, a small town 8 miles above the mouth, is about 3 feet at low water.

The variation of water surfaces, due to tides, is from 5 to 8 feet.

This stream is used extensively for logging purposes, logs being floated from the headwaters, a distance of about 10 miles.

The commerce of this stream consists principally of logs towed from the lower portion of the stream to the mills along the Columbia, and some farm products and supplies handled by a small boat plying from Astoria. Statistics, other than 938,000 feet of logs towed, are not available.

The river is the only means of transportation, and aside from furnishing easier navigation for the light-draft boats using the channel, it is not believed the improvement will have any tendency to reduce the present rates of transportation.

The winter freshets usually bring down snags and logs, and the available balance, together with the amount estimated as a profitable expenditure, will be applied to the purpose of removing them, as may be necessary.

July 1, 1908, balance unexpended	$1,386.70
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,016.17
July 1, 1909, balance unexpended	370.53
July 1, 1909, outstanding liabilities	260.15
July 1, 1909, balance available	110.38
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	500.00

PUGET SOUND AND ITS TRIBUTARY WATERS, WASHINGTON.

Most of the channels of Puget Sound proper have ample depths for purposes of navigation, but the extensive lumber and fishing industries in these waters render it very important to maintain a general supervision over the navigable channels, to regulate the construction of fish traps, log booms, and other structures incident to these important industries, and to prevent obstructions which are detrimental to general navigation. A number of streams and rivers tributary to Puget Sound are of great value to boat navigation, but they are all liable to be obstructed by the débris generally found in streams flowing through a heavily wooded country.

All these streams are used to a greater or less extent for floating logs and shingle bolts, and the towing of log rafts and timber products constitutes the main part of the commerce. The distance upstream to which boats run is extremely variable, depending on the stage of water and tide. Steamboat navigation on the Skagit extends as far up as the mouth of the Sauk, but boats do not often ascend above Hamilton or Birdsview. No survey has been authorized by Congress above Sedro Woolley, 25 miles above the mouth of the river. On the Stilaguamish boats do not go above Florence, 6 miles from the mouth. The Snohomish is navigable for river boats to the Forks, 22 miles, and the lower portion of one of its tributaries, the Skykomish, is navigable at high stages. The Snoqualmie River is navigable at a low-water stage for a distance of 30 miles from the Forks, and at high stages for an additional distance of 20 miles. On the Duwamish small boats go as far the junction of the White and Black rivers, about 16 miles from the mouth. Under favorable conditions they can go several miles up the White, and occasionally boats pass up the Black into Lake Washington. On all these streams the distances to which steamboat navigation actually extends are generally less, and the distances over which towing and floating of logs extend are greater than the distances above named. None of these streams is closed in winter by ice. All are affected by the tidal variation in Puget Sound, which is large and extremely irregular.

The work of improvement consists in the maintenance of the navigable channels by snagging and removing obstructions.

Formerly works of improvement were carried on under specific appropriations, but since the act of June 13, 1902, appropriations have been made in the present general and comprehensive form, except in cases of large local works. This method operates greatly to the advantage and economy of the work.

The amount expended to June 30, 1909, was $337,387.60.

The act of March 2, 1907, provided for the removal of the rock in the entrance to Roche Harbor at a cost not to exceed $30,000. The work was begun October 1, 1907, under contract, and completed April 17, 1908.

The water traffic on Puget Sound and its tributary waters is very large and rapidly growing. It includes vessels of about every type and size in use throughout the world, but it is quite impracticable to give in the form of concise statistics a condensed statement of the amount and value of the commerce more or less directly benefited by work under this appropriation. Statistics have been compiled only for the tributary streams on which the snag boat has mostly worked.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1898	12,676	$539,406	1904	92,465	$1,790,823
1899	13,500	577,586	1905	86,412	1,817,048
1900	35,066	1,324,926	1906	167,197	1,898,057
1901	30,155	1,499,420	1907	124,336	3,011,146
1902	61,794	2,324,980	1908	44,922	1,659,930
1903	94,274	3,193,458			

No definite information relative to effect of the work on freight rates is available, but the increasing number of vessels engaged indicates greater competition.

Reports of examinations and surveys of the rivers of Puget Sound are referred to in Annual Report of the Chief of Engineers for 1904, page 692.

Reports on examinations and surveys of the Skagit and Snohomish rivers under the river and harbor act of March 2, 1907, were published in House Documents Nos. 1108 and 1188, Sixtieth Congress, second session.

Reference to reports on the examination and survey of the Duwamish River authorized by the river and harbor act of March 3, 1905, will be found on page 787 of the Annual Report of the Chief of Engineers for 1906.

During the past year the snag boat operated extensively in all parts of the Sound, doing a large amount of work.

The snag boat is no longer capable of serving the needs of the district. It was built in 1882, the hull renewed in 1896, and it is now in a condition that practically requires another renewal. It is not sufficiently seaworthy to be safe in ordinary rough weather in the Sound. A new plant is required, and it is proposed to provide a combined snag boat and small suction dredge to do such work as is not of sufficient magnitude to be undertaken by contract.

There is a considerable amount of miscellaneous work in the district that is paid for from this appropriation, such as investigation of harbor lines, bridges, obstructions, occasional surveys, gauge readings, etc.

The snag boat was in commission three hundred and thirty-five days during the year and laid up undergoing repairs for a period of thirty days.

The following table shows the work accomplished on the streams tributary to Puget Sound:

Name of river.	Time.	Number of snags removed.	Length.	Number of trees cut.	Length.
	Days.		*Feet.*		*Feet.*
Skagit	151	1,774	28,119	149	14,030
Snohomish	90	1,257	21,122	224	12,835
Snoqualmie	67	1,494	22,289	248	13,280
Stilaguamish	19	207	2,596	.....	.....
Swinomish Slough	8	5	156	.....	.....
Total	335	4,737	74,282	621	40,065

The Snoqualmie River was cleared of snags and made navigable for small vessels for a distance of 30 miles. One gasoline vessel now makes daily trips over that portion of the river, which it was impossible to do prior to the removal of obstructions by the snag boat.

July 1, 1908, balance unexpended	$23,937.30
Amount allotted from appropriations by river and harbor act approved March 3, 1909	25,000.00
Miscellaneous receipts	126.35
	49,063.65
June 30, 1909, amount expended during fiscal year for works of improvement	21,161.75
July 1, 1909, balance unexpended	27,901.90
July 1, 1909, outstanding liabilities	5,202.02
July 1, 1909, balance available	22,699.88
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	120,000.00

PUGET SOUND-LAKE WASHINGTON WATERWAY, WASHINGTON—LOCK CONSTRUCTION.

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 953, Sixtieth Congress, first session:

WASHINGTON, D. C., *March 30, 1908.*

GENERAL: Section 1 of the act of March 2, 1907, contained the following item:

"Improving the waterway connecting Puget Sound with Lakes Union and Washington, Washington: For maintenance of improvement, ten thousand dollars; and the Secretary of War may make a survey and estimate of cost of said waterway or canal with one lock, with a view to the construction of the same, in conjunction with the county authorities of King County or other agency, of sufficient size to accommodate the largest commercial or naval vessels afloat; or, if deemed more advisable, with a view to the construction of a canal of less dimensions, and to submit dimensions and estimate of cost of same, together with a report upon what portion of said work will be done or contribution to be made by said county or other agency. And the provisions of the act approved June eleventh, nineteen hundred and six, authorizing James A. Moore, or his assigns, to construct a canal, with suitable timber lock, are hereby so modified as to permit the said James A. Moore, or his assigns, subject to the conditions and stipulations of the act, to excavate a channel seventy-five feet wide at the bottom and twenty-five feet deep at mean low water from deep water in Puget Sound at the mouth of Salmon Bay to deep water in Lake Washington, in lieu of constructing the canal and timber lock specified in the said act, the location of the said channel and work of excavation to be subject to the direction of the Sec-

retary of War, and the plans and order of work to be subject to his approval before beginning and when completed and accepted by the Secretary of War, the channel to be and remain a free public waterway of the United States."

Having reviewed the accompanying report of the district officer on the survey required by the above-quoted item, the Board has the honor to submit its views and recommendations thereon.

The question of a navigable waterway to connect Puget Sound with Lakes Union and Washington has been under consideration for a great many years. A brief analysis of the several reports which have been submitted on this subject, and a history of the improvement as far as carried, are outlined in the accompanying report of the district officer. The present investigation is for the purpose of determining the cost of a waterway with one lock of sufficient dimensions to accommodate the largest commercial or naval vessels afloat, or of a lesser size if deemed more advisable, the report to take into consideration "what portion of said work will be done or contribution to be made by King County or other agency."

The district officer submits a plan with estimates of cost for a waterway of sufficient size to accommodate all commercial vessels likely to visit the port, including those in the class of the steamship *Minnesota* and all vessels of the American Navy except the two largest battle ships now contemplated but not yet constructed. The estimates provide for a lock 825 feet by 80 feet, with 36 feet depth on the sills at mean tide, or 25 feet at extreme low tide. Two estimates are made for the waterway, one 75 feet wide on the bottom and 25 feet deep, and one 100 feet wide on the bottom and 36 feet deep. He recommends the adoption of a project for the waterway with the lesser dimensions, stating that it will afford adequate facilities for many years to come and will admit of enlargement should it become necessary in the future. He proposes to have in addition to the main lock an auxiliary lock of sufficient size to accommodate the greater number of vessels expected to use the waterway, this lock to be placed alongside of the main lock, its dimensions to be 150 feet by 30 feet, with 16 feet depth over the miter sills. Middle gates are proposed for the large lock, so as to divide its length into two chambers 350 and 475 feet in length. Thus, four chambers will be made available, respectively 150, 350, 475, and 800 feet long. By having these four chambers of various sizes a vessel can be very economically locked through by using the chamber best adapted to its size, thus minimizing the power required for the operation of the locks and the quantity of water to be used.

The district officer recommends that the controlling works at the lock be in the nature of a power plant to utilize the outflow through the canal so far as it is not required for lockage, the plant to be built and owned by the Government and leased to outside interests, the revenue to be applied to the cost of maintaining and operating the canal. If such recommendations are not approved, he is of opinion that the controlling works should be in the form of a simple dam closed by ordinary flashboards, and that no plant should be installed for operating the locks, but that electrical power be purchased for that purpose until such time as private interests may seek the privilege of developing the power, when the condition may be imposed that the necessary power for canal use shall be furnished free of cost.

It is proposed to improve the entrance to the canal through Shilshole Bay by means of bulkheads, behind which dredged material will be deposited, and to light the entrance and canal. Marking and lighting the waterway may eventually be placed under charge of the Light-House Department, but it appears desirable during construction, and for a time at least thereafter, for this part of the work to be provided for in the estimate.

The following is an estimate of the work proposed by the district officer:

Right of way	$15,000
Excavation (canal 75 by 25)	1,064,341
Lock with power plant	2,420,520
Entrance works	50,071
Marking and lighting	5,000
Total	3,554,932

Deducting $1,064,341, the estimated cost of excavation which it is proposed shall be done by local interests, from the total cost of the work, leaves $2,490,591 as the cost of the work to be done by the United States, or as the district officer states in round numbers, $2,500,000. Maintenance is estimated at $30,000 annually. A considerable part of the cost of maintenance may be raised by the lease of the power plant as suggested by the district officer.

Under the heading "Commercial and Industrial Advantages of the Canal,"[a] the district officer describes quite fully the benefits that will accrue to local interests and to general commerce and navigation. These may be summarized as follows: A large

and commodious fresh-water basin will be provided where vessels can lie at anchor, receive and discharge cargoes at the wharves, and at the same time have the benefit of the fresh water in removing barnacles from the hulls. A large area will be made available for the location of industrial plants on the shores of the lakes and connecting waterways, sufficient, no doubt, to accommodate a city of several million inhabitants. A great saving to the lumber interests will result from their being able to store logs in fresh instead of salt water, thus avoiding the destructive effects of the teredo. And the cost of building and maintaining wharves and piers on the lakes will be much less than on the sounds, owing to much more favorable depths and the absence of marine life.

The growth in the commerce of this port has been very marked, as indicated by the report of the district officer, and there seems to be no reason to doubt that it will continue to increase for many years. The annual tonnage, not including local traffic, is now reported as 2,831,355 tons

With reference to the query contained in the item of law under which this report has been made, viz, "what portion of said work will be done or contribution to be made by said county or other agency," it appears that local interests propose to contribute liberally toward the construction of the canal. According to present plans it is proposed to raise for this purpose the sum of about $1,500,000 to be devoted to canal purposes. The district officer suggests that the best means of cooperating with the county of King or other local agency is for them to do a certain part of the work rather than to supply a specific sum of money, and he recommends that this work be the excavation, which according to estimate will amount to a little over $1,000,000. The division engineer concurs in the recommendations of the district officer as outlined above.

The question of improving this waterway came before the Board of Engineers for Rivers and Harbors in 1905 by resolution of the Committee on Rivers and Harbors of the House of Representatives, as follows:

"Waterway connecting Puget Sound with lakes Union and Washington, including modifications of the same with a view to cheapening the cost, including a plan which shall contemplate but one lock."

The Board's report was submitted under date of November 8, 1905. Up to that time the proposed plan of improvement, which, however, had not been formally adopted, contemplated a ship canal from deep water in Puget Sound through Salmon Bay and Lake Union to Lake Washington, with one lock between the bay and Lake Union, and one between Lake Union and Lake Washington, the canal and locks to be of sufficient size to accommodate the largest merchant vessels and ships of war. The estimated cost of the work complete was about $8,000,000. This sum represented the outlay to be made by the General Government, as it was not proposed at that time that local interests should share in this expense.

On account of the excessive cost of the work, the idea of a modified plan was suggested, involving one lock to connect Puget Sound with Lake Union only, omitting connection with Lake Washington and reducing the size of the canal and lock so as to accommodate vessels of moderate draft only. The estimated cost of this plan was $1,665,406.43 and $50,000 annually for maintenance. This plan contemplated only the use of Lake Union, and while it would have afforded room for considerable commercial expansion, the connection with Lake Washington, involving a second lock, would ultimately have had to be faced. The total improvement would have been very expensive and would have provided a waterway of only moderate capacity. The board was of opinion that neither the plan for connecting the Sound with lakes Union and Washington by means of two locks nor the one for connecting the Sound with Lake Union only by one lock of moderate size was advisable.

The present consideration has in view the development of the waterway so as to make available for commercial and other purposes both lakes Union and Washington by the construction of one lock and connecting canal, the elevation of Lake Washington to be lowered to that of Lake Union. This plan appears to be the best solution of the problem that has been suggested. It will be more simple and less expensive than the one involving two locks, and it appears that the lowering of Lake Washington will be advantageous to the community, as much as of the surrounding country is subject to overflow under existing conditions. The whole subject of the improvement is now presented in a much more favorable light, as it is proposed by local interests to contribute a large sum toward the enterprise in view of the undoubted advantages that will accrue to the community.

The amount of money which the Government has expended at the port of Seattle is not large when compared with its present commerce, and the Board believes that the benefits to result from this improvement as now proposed will be sufficient to warrant the expenditure of the additional sum necessary for its execution. The Board believes that the dimensions of the waterway as proposed by the district officer are sufficient

to provide adequate facilities for all vessels likely to use it for many years to come, and it concurs with the division engineer in recommending the adoption of the project as outlined by the district officer.

It is recommended further that the undertaking of the project by the United States be made contingent upon the furnishing to the Secretary of War of satisfactory evidence:

First. That King County or other local agency will do the excavation in the waterway above the lock to the dimensions recommended.

Second. That the said King County or other local agency will hold the United States free from any claims or damages on account of the grant made to James A. Moore or his assigns in the act of June 11, 1906.

Third. That the said King County or other local agency will hold the United States free against any claims or damages on account of lowering the level of Lake Washington, raising the level of Salmon Bay, or any other alteration of the level of any part of said waterway.

For the Board:

Very respectfully,

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

WATERWAY CONNECTING PUGET SOUND WITH LAKES UNION AND WASHINGTON, WASHINGTON—MAINTENANCE.

Lakes Union and Washington are bodies of fresh water near Puget Sound, in the immediate vicinity of the city of Seattle. Lake Union is entirely within the city limits. The proposed improvement originally contemplated a ship canal connecting both lakes with the Sound. There is no navigable connection at present.

A succinct history of the project and references to reports, etc., may be found on pages 791 to 793 of the Annual Report of the Chief of Engineers for 1907.

The only actual work done on the proposed waterway has consisted of dredging a channel from the Sound to the wharves at Ballard, in Salmon Bay, and the excavation of a cut between Lake Union and Salmon Bay, for the control of the water level in Lake Union. The work was done under the river and harbor acts of June 3, 1896, and March 3, 1905. It has resulted in a channel 50 feet wide and 16 feet deep at low water from Puget Sound to a point 2,000 feet west of the lock site. From this point to the lock site the channel is 75 feet wide and 16 feet deep. From the lock site to the railroad trestles at the eastern part of Ballard Harbor the channel is 75 feet wide and 10 feet deep at low water. A turning basin ranging from 175 feet to 500 feet in width has been dredged at Ballard.

The amount expended to June 30, 1909, was $470,072.77. Of this amount $22,992.93 was expended in maintenance and on improvement of drainage of Lake Washington. The expenditures during the past year were for operating outlet gates and general care of the right of way.

The present commerce benefited by the improvement of the channel to Ballard is the towing of logs to the mills at Ballard and the export of lumber and shingles from that place. Logs are brought in in rafts and lumber is loaded on sailing vessels and scows at the mills and then towed to the open sound.

It has not been practicable to determine what effect the improvement work has had upon freight rates.

The maximum draft that could be carried to the wharves at Ballard, June 30, 1909, at extreme low water, was 10 feet. The maximum tidal variation is about 18 feet.

Early in 1906 a movement was started for the construction of the canal with local funds and to this end secured the passage of an act of Congress, approved June 11, 1906, authorizing James A. Moore or his assigns to construct a canal along the government right of way connecting the waters of Puget Sound with Lake Washington. This act was modified by the act of March 2, 1907, so as to permit Mr. Moore or his assigns to commute the work required under the previous act to excavation alone of a canal from deep water in Puget Sound to deep water in Lake Washington, with a bottom width of 75 feet and a depth at mean low water of 25 feet. The same act directed a survey and estimate of cost of a canal with a single lock and a report as to what contribution, if any, local interests would make toward its construction.

To assist the United States through the agency of the Moore acts in building a canal, the county of King voted a bond issue of $500,000 on September 12, 1906. These bonds were declared invalid by the supreme court of the State. An attempt was made by the legislature to remedy the defect, but its efforts were not upheld by the supreme court.

On March 13, 1907, the state legislature passed an act creating a local assessment district, embracing territory that would be benefited by the canal, and empowering the district to raise by taxation a sum not exceeding 1 per cent of the taxable valuation of the county, and to use the money so received to aid in constructing the canal. The board of appraisement was appointed by the local United States district judge, and the money is to be expended under the direction of the United States engineer officer in charge of the local engineer district. Under this act the district was duly formed by the necessary action of the county commissioners, the board of appraisement was appointed, and the work of making the assessment is completed. The assessment has to be considered by the county commissioners sitting as a board of equalization, after which it is subject to collection, either in cash or in issue of bonds. The board of county commissioners declined to act as a board of equalization and proceedings were begun in the superior court to compel the commissioners to act. The lower court rendered a decision against the contention of the county commissioners and the case will be carried to the supreme court of the State. The sum to be raised under the assessment act is $1,075,000, which is intended to yield, after the cost of assessment and collection and other incidental expenses are paid, the sum of $1,000,000 in aid of the canal.

On March 17, 1909, the state legislature passed an act creating the state shore-land improvement fund and appropriated out of said fund the sum of $250,000 to be expended in the construction of the Lake Washington Canal, under the direction of the United States engineer officer in charge of the local engineer district.

The total local contribution now in view is, therefore, $1,250,000.

A report on survey required by the river and harbor act of March 2, 1907, was published in House Document No. 953, Sixtieth Congress, first session.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1901	410,565	$2,002,950	1905	888,161	$4,588,196
1902	428,073	2,432,401	1906	705,841	3,993,410
1903	524,500	2,219,000	1907	797,228	5,520,518
1904	584,079	2,520,785	1908	530,352	3,098,954

NOTE.—The above includes only the present commerce of Ballard and Salmon Bay, Lake Union, and Lake Washington.

The loading of vessels with lumber has been largely facilitated by the work done in Ballard Harbor. Formerly the lumber was taken out by means of lighters to the vessels anchored in the Sound. Now all but the largest vessels are brought to the mills to receive their loads.

The appropriation recommended will be applied to maintenance of existing channels and care of outlet gates at Lakes Washington and Union.

July 1, 1908, balance unexpended	$1,033.73
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
Received from sales	.50
	6,034.23
June 30, 1909, amount expended during fiscal year for maintenance of improvement	1,106.50
July 1, 1909, balance unexpended	4,927.73
July 1, 1909, outstanding liabilities	67.00
July 1, 1909, balance available	4,860.73
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	5,000.00

SKAGIT RIVER, WASHINGTON.

Report on a recent survey is printed in House Document No. 1188, Sixtieth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 7, 1908.

SIR: I have the honor to submit herewith for transmission to Congress reports of April 15, 1907, and March 31, 1908, with map, by Maj. H. M. Chittenden, Corps of Engineers, together with supplemental report of November 3, 1908, by Maj. C. W. Kutz, Corps of Engineers, all in regard to preliminary examination and survey of Skagit River, Washington, up to Sedro Woolley, authorized by the river and harbor act approved March 2, 1907.

Skagit River has been under improvement by the United States since 1880, with a view to the removal of snags and other channel obstructions. In his survey report of March 31, 1908, Major Chittenden presents a plan for more radical improvement, at an estimated cost of $175,000. In his opinion the work recommended is justified by the commercial interests involved, and his views and recommendations were concurred in by the division engineer at that time, Lieut. Col. S. W. Roessler, Corps of Engineers.

From the facts and for the reasons given in its report of August 31, 1908 (also herewith), the Board of Engineers for Rivers and Harbors found itself unable to concur in recommending the plan of improvement thus proposed. At the request of the Board,

however, the matter was again referred to the local engineer officer for further consideration of certain features of the work suggested.

In his supplemental report of November 3, 1908, Major Kutz (now in local charge) presents a modified plan for obtaining a reliable channel of entrance through the delta at the mouth of Skagit River, at an estimated cost of $100,000, and expresses the opinion that the cost of this work is warranted by the existing and prospective commerce. This opinion is concurred in by the Board of Engineers for Rivers and Harbors, and this modified project is recommended for adoption.

I concur in the views and recommendations of the Board.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

This stream annually carries about 25,000 tons of commerce, valued at about $1,000,000. In addition, about 150,000 tons of logs and lumber products are floated down the stream.

SNOHOMISH RIVER, WASHINGTON.

Report on a recent survey is printed in House Document No. 1108, Sixtieth Congress, second session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., July 13, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

Everett Harbor, at the mouth of the Snohomish River, has been improved by the United States at a total cost of about $414,000. The principal work done consisted in the construction of a bulkhead or dike about 3½ miles long, extending from Smiths Island, at the mouth of Old River, one of the outlets of the Snohomish, through the delta to deep water in Gardner Bay; the dredging of a channel or basin 400 feet wide, 26 feet deep, and about 1 mile in length on the harbor front under the lee of the jetty; and some dredging to a depth of 6 feet in the river itself. It appears there is ample depth now in the outer harbor and in the dredged basin at the mouth of the river, but insufficient depth in the river itself, on the banks of which are located many of the important industries of the city of Everett. The Snohomish River carries a fairly good depth in its upper portion, but near its mouth, where the water is dissipated through a number of channels, portions of the river are practically dry at the lowest stages.

The improvement now desired is the deepening of Old River and the Snohomish in the vicinity of Everett. To accomplish this the district officer suggests two plans—one to carry the stream between parallel jetties or training dikes a distance of about 16,000 feet to deep water in the sound; the other, by the construction of one dike 11,500 feet long, to carry the river to its present outlet in Gardner Bay. It is also proposed to partially close by mattress sills various subsidiary sloughs so as to increase the volume of water flowing down the proposed channel, and thus concentrate the tidal and current energy of the river. He also proposes to dredge to a depth of 8 feet and a width of 75 feet a channel from the deep water in the basin up to Steamboat Slough, a distance of about 5.3 miles. While it may eventually be desirable to carry the dredging farther upstream, the district officer believes it to be advisable to limit it to the stretch mentioned until the result of the work that far has been determined. The second plan has such apparent advantages over the first that no estimate of the latter is given. The cost of the plan proposed is $280,000. To this extent he believes the further improvement of this locality desirable, and in this view the division engineer concurs.

With a view to securing all possible information in regard to this improvement, the Board, through a committee of its members, made a personal inspection of the locality on January 25, 1908, and held a public hearing in the city of Everett where all those who desired were given an opportunity to present their views in regard to the necessities of further improvement. A number of communications were presented to the Board and considerable interest was manifested in the proposed improvement.

It appears from statistics presented that during 1907 about 11,342 tons of rock, iron, iron products, and fish, 312,200,000 feet of logs, 13,150,000 feet of lumber, 6,143,400 linear feet of cedar poles, and 1,120,551 feet of piles were handled on the river between its mouth and Lowell, the total value of which exceeded $6,500,000. The exports and imports through Everett Harbor amounted to about 102,000 tons, not including 50,000,000 feet of lumber, with an aggregate value of about $5,000,000.

As the range of tide in this locality is about 18 feet, the improvement proposed will permit seagoing vessels of moderate draft to use the river at all stages above mean tide, and will afford facilities for light-draft vessels and for transfer barges at all times. The district officer states that there are numerous establishments along this section of the river, and that it is more advantageous and less costly to locate here than upon the main harbor front of the city. The tendency of the development along this line was evident from the examination made by the committee of the Board.

The growing importance of Everett and the manifest advantage the further improvement proposed would have on the development of the city, coupled with the fact that the full benefit of the work already done by the Government will not be realized unless supplemented by the improvement of the river, at least to some extent, leads the Board to concur with the district officer and the division engineer in believing it to be advisable for the United States to undertake the improvement now proposed at a cost of $280,000. It appears that certain physical elements entering into the proposed improvement render the question of future maintenance very uncertain and an estimate of its cost impracticable. This item of expense will have to be based on the experience had after the completion of the work.

In regard to the details of the work proposed, the Board believes that it may be advisable to raise the closing sills somewhat higher than proposed by the district officer, but it seems better to undertake the work tentatively as proposed, and decide upon the exact elevation of the sills after the result of the first work has been noted. It may also be desirable to change the alignment of the dredged channel in at least one place, so as to follow more closely the curved lines of the proposed dike. This question, however, should be left for the decision of the district officer after the dike has been constructed and the trend of the currents noted.

SWINOMISH SLOUGH, WASHINGTON.

This slough affords an inland sheltered passage for small vessels from Puget Sound proper northward to Bellingham Bay and the Gulf of Georgia, and it is the only means of communication to the town of La Conner, located on the slough. At the northern end the slough opens out through the mud flats of Padilla Bay and on the south into Saratoga Passage through the mud flats, forming the delta of the Skagit River. The total distance from deep water in Saratoga Passage to deep water in Padilla Bay is about 11 miles. This waterway is of great importance to traffic between Puget Sound and points north in giving an inside passage for small craft in rough weather, and an outlet for the agricultural and timber products from the surrounding country.

The original and present project, adopted by Congress by act of July 13, 1892, contemplates dredging a channel 4 feet deep in Saratoga Passage across Skagit flats, through the shoals of the slough proper, and across the flats of Padilla Bay to deep water, and building dikes in Skagit Bay to control the tidal currents.

The entire work done under this project was not entirely successful, owing to insufficient knowledge of the conditions and the character of the work required to meet them. The work of the last few years has been of a more substantial character.

The amount expended to June 30, 1909, was $204,967.32, of which $31,233.45 was for maintenance.

The dike work completed to date between La Conner and Saratoga Passage is as follows: Pile, brush, and stone dike on the north side of the channel from "Hole in the Wall" to opposite the west end of Goat Island, 7,100 linear feet; on the south side of the channel from the west end of Goat Island to deep water in Saratoga Passage, 3,650 linear feet; and from McGlinns Island to the mainland in the direction of La Conner, 3,500 feet.

Dike work was completed on July 24, 1908, as far as available funds would permit.

The work accomplished has not had any effect on freight rates.

The appropriation recommended will be applied to maintenance of existing channels and dikes.

A report on examination and survey of Swinomish Slough, upon which the plan of improvement is based, is referred to in Annual Report of the Chief of Engineers for 1904, page 699.

A map showing parts of the improvement is published in the Annual Report of the Chief of Engineers for 1900, opposite page 4488.

The average tidal variation is about 8 feet.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1898	19,625	$882,345	1903	51,399	$1,473,197
1899	76,636	2,028,454	1904	56,262	1,539,094
1900	74,516	1,611,460	1905	48,724	1,363,729
1901	136,747	2,991,330	1906	53,261	1,494,382
1902	49,914	1,472,847	1907	46,289	1,582,656

July 1, 1908, balance unexpended	$1,387.85
Amount allotted from appropriation by river and harbor act approved March 3, 1909	10,000.00
	11,387.85
June 30, 1909, amount expended during fiscal year, for works of improvement	1,355.17
July 1, 1909, balance unexpended	10,032.68
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

WILLAPA HARBOR AND RIVER, WASHINGTON.

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 524, Sixty-first Congress, second session.

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., November 29, 1909.

Respectfully returned to the Chief of Engineers, U. S. Army.

The existing depth in this river is 15 feet at low water below South Bend and 13 feet between South Bend and Raymond. Local interest desire a channel 24 feet in depth from deep water in the harbor to the city of Raymond. For reasons stated within, in which the Board concurs, the district officer states that by taking advantage of the tides a mean low-water channel depth of 18 feet will be sufficient to meet reasonable requirements of navigation, and he submits an estimate for a channel of that depth and 200 feet in width from deep water in the bay to the junction of the North and South forks of the river at Raymond, and of the same depth and 150 feet in width for a distance of 3,100 feet up the South Fork.

The total estimate for the work proposed is $218,132.20, and $5,000 annually for maintenance. This estimate involves an item of $5,500.24 for dredging at the city of Raymond. The total estimated cost of this item is $11,000.48, but on account of the benefits to accrue to local property owners the district officer makes his recommendation contingent upon the city of Raymond, or the property owners interested, contributing one-half the expense of this item, and also constructing necessary bulkheads and furnishing a place for the deposit of dredged material free of cost to the United States, both for the work proposed at and below Raymond and also for that below South Bend.

The commerce of the locality has been increasing steadily since 1902, and is reported for 1908 as amounting to 213,000 tons. The expenditures on this harbor by the General Government to June 30, 1908, were $60,834.64.

In view of the importance of the commerce involved and the relatively small federal expenditures made up to the present time, the Board has arrived at the conclusion that the improvement proposed within, conditioned upon the local cooperation suggested by the district officer, is worthy of being undertaken by the General Government in the interests of commerce and navigation.

In compliance with the provisions of section 13 of the act of March 3, 1909, the Board further reports that neither the establishment of terminal facilities, the development and utilization of water power for industrial and commercial purposes, nor any other subjects not considered within, are so related to the project for improvement of navigation at this locality as to be coordinated in a logical and proper manner with such project to lessen the cost thereof and to compensate the Government for expenditures made in the interest of navigation.

For the Board:

JOHN G. D. KNIGHT,
Colonel, Corps of Engineers,
Senior Member of the Board.

POLSON BAY, FLATHEAD LAKE, MONTANA.

Report on a recent survey is printed in House Document No. 645, Sixty-first Congress, second session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., January 28, 1910.

Respectfully returned to the Chief of Engineers, U. S. Army.

A survey of Polson Bay having been made by the district officer, it appears that the only work necessary to provide a channel 6 feet deep at low water up to the wharves at Polson is the removal of a quantity of loose bowlders. A project for this work, contemplating an approach channel 100 feet wide, with a turning basin near the wharves, is submitted by the district officer, at an estimated cost of $6,000. This project meets the approval of the division engineer.

In addition to the reports of the district officer on preliminary examination and survey of this locality, the Board has had before it a number of papers submitted by interested parties. From the information available it appears that there are a number of boats now doing business between the several towns on Flathead Lake and that these boats are inconvenienced by the insufficient depth at Polson. This town is on the Flathead Indian Reservation, which has been recently opened to settlement, and it is expected that the occupation of the lands will begin during the coming spring, and that as a result of this settlement the commerce of the locality will be increased and the importance of the water route correspondingly augmented.

In view of the above, and having in mind the small cost of the proposed improvement, the Board reports that in its opinion Polson Bay is worthy of improvement by the United States to the extent of providing a channel 6 feet deep at low water to the wharves at Polson in the manner contemplated by the district officer, at a total estimated cost of $6,000.

In compliance with the provisions of section 13 of the act of March 3, 1909, the Board reports that there are no questions of terminal facilities, water power, or other subjects so related to the project proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures made in the interests of navigation.

ST. MICHAEL CANAL, ALASKA.

The St. Michael Canal is a channel running from St. Michael Bay to a point on Norton Sound about 38 miles from the Apoon mouth of the Yukon River.

The port of St. Michael is about 3 miles from the mouth of the canal.

The main part of the canal has sufficient water for the navigation of river boats plying on the Yukon River. The eastern entrance to the canal is, however, obstructed by shoals, and in the eastern portion

there are several sharp bends that could be turned with difficulty by the larger river boats.

The object of the improvement of the canal is to provide a sheltered passage to river boats between St. Michael and the mouth of the Yukon River.

The original and existing project contemplates dredging in the South Branch a channel 100 feet wide to a depth of 6 feet at mean low water at the entrance to the canal and the excavation of a cut of the same dimensions across the first bends. The estimated cost was $248,000. The project was adopted by the act of March 2, 1907, and the full amount of the estimate has been appropriated.

To June 30, 1909, there has been expended on the existing project $62,047.55.

The work is being done under a continuing contract, and was begun July 5, 1908, and continued until October 5, 1908, when it was suspended for the season.

A channel 3,400 feet long, 100 feet wide, and 6 feet deep was excavated, and 37,297.8 cubic yards of material removed.

The original estimate for this work was based on a unit price for dredging of 50 cents per cubic yard, while the lowest bid received was $1.45 per cubic yard.

To carry out the original project would require an additional appropriation of nearly double the amount heretofore appropriated.

The district officer in his report recommends the modified project for the work not now under contract, which will reduce the cost about $275,000, but action on this modified project has been delayed pending a personal investigation by the district officer.

The additional funds asked for will be required for the prosecution of the work during the season of 1910.

The maximum draft that can at present be carried at low water is 3 feet. The mean range of tide is 3½ feet.

Statement of freight between St. Michael and mouth of Yukon River.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1897	5,270	$512,650	1903	20,000	$1,652,891
1898	22,117	2,132,580	1904	17,356	1,316,287
1899	17,295	1,704,525	1905	25,855	2,220,890
1900	19,153	1,950,950	1906	31,999	2,799,187
1901	18,153	1,844,651	1907	29,793	2,493,697
1902	16,008	1,630,950	1908	23,785	2,090,400

It is not expected that this improvement will have any effect on freight rates.

July 1, 1908, balance unexpended	$245,241.43
June 30, 1909, amount expended during fiscal year, for works of improvement	59,288.98
July 1, 1909, balance unexpended	185,952.45
July 1, 1909, outstanding liabilities	621.33
July 1, 1909, balance available	185,331.12
July 1, 1909, amount covered by uncompleted contracts	176,826.38
Amount (estimated) required for completion of existing project	100,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	100,000.00

HARBOR AT HILO, HAWAII.

Hilo Bay is practically a deep open roadstead, protected to a limited extent by Blonde reef, but otherwise exposed through the angle formed by lines drawn from Hilo town to Kanaha and Keokea points—that is, from about north to north 74° east (magnetic). Strong northeasterly trade winds prevail most of the time. These winds cause a choppy sea outside of Hilo Bay and considerable swell in the bay, which at times makes it unsafe for ships to lie at the existing wharves and renders loading and unloading in the bay difficult. The heaviest seas, however, come from the north during northerly and northwesterly storms, and during this weather it is often impossible for ships to lie at the wharves or even work in the bay.

The present project, adopted by Congress March 2, 1907, consists in constructing a rubble mound breakwater along Blonde reef to a point on shore about 6,000 feet east of Cocoanut Island, at an estimated cost of $1,700,000, as stated in House Document No. 407, Fifty-ninth Congress, second session.

As authorized in the act of March 2, 1907, the project as originally stated in the above-mentioned House document has been modified in a manner recommended on page 16 of the House document by the elimination of the third, or shore, arm of the breakwater and the extension of the middle arm of the breakwater to the shore.

For map see page 2316 of the Annual Report of the Chief of Engineers for 1908.

Between March 2, 1907, and March 4, 1909, $400,000 has been appropriated for work under the approved project, or about 23 per cent of the estimated cost of the work under that project. Under a continuing contract the actual construction of the breakwater was commenced on September 12, 1908, and on June 30, 1909, a total of 31,507 tons of stone had been placed, making a total of 766 feet of completed breakwater.

On June 30, 1909, the sum of $71,000.86 had been expended, all on the present project, and no part being for maintenance.

The approved project is about 4 per cent completed.

The commerce of this port for the calendar year 1908 was valued at more than $16,000,000, and amounted to more than 184,000 tons.

Work on this improvement has not been carried far enough to have any effect on freight rates.

It is proposed to apply the amount estimated as a profitable expenditure in the fiscal year 1911 to continuing the work of constructing the breakwater. The additional work proposed is necessary to make the improvement available.

July 1, 1908, balance unexpended	$298,274.87
Amount appropriated by sundry civil act approved March 4, 1909	100,000.00
	398,274.87
June 30, 1909, amount expended during fiscal year, for works of improvement	69,275.73
July 1, 1909, balance unexpended	328,999.14
July 1, 1909, outstanding liabilities	573.00
July 1, 1909, balance available	328,426.14

July 1 1909, amount covered by uncompleted contracts	$301,355.44
Amount (estimated) required for completion of existing project	1,300,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	600,000.00

HONOLULU HARBOR, HAWAII.

This harbor is situated on the south coast of the island of Oahu. The entrance channel, through a coral reef, and the harbor proper, were dredged from time to time by the monarchical, republican, and territorial governments of Hawaii prior to July 1, 1904. On this date there existed an entrance channel having a minimum width of about 200 feet and a depth of about 35 feet at mean low water. The harbor proper had a general width of 900 feet. The water for about 200 feet immediately along the wharves had a depth of from 30 to 32 feet. Elsewhere there was only about 27 feet at low water. The bend at the light-house point was so sharp as to make it somewhat difficult for large vessels to make the turn.

Work on the present project was begun under an appropriation by the river and harbor act of March 3, 1905, in accordance with a general plan printed in the Annual Report of the Chief of Engineers for 1905, page 2564, but the project as specifically adopted by the river and harbor act of March 2, 1907, is printed in House Document No. 332, Fifty-ninth Congress, second session. It provides for an entrance channel 400 feet wide and 35 feet deep at mean low water from deep water at the entrance to the light-house point, for easing the curve at the junction of the entrance channel and the inner harbor by cutting off the light-house point, and for enlarging the harbor proper so that it will have a general width of 1,200 feet and a depth of 35 feet at mean low water, at an estimated cost of $1,628,894.60.

Between March 3, 1905, and May 27, 1908, $800,000 have been appropriated for work under the approved project, or about 49 per cent of the estimated cost of work under that project.

Work under the above appropriations was stopped by practical exhaustion of funds on December 15, 1908. The following has been accomplished:

Dredging entrance channel, removing light-house point, and the partial widening of the harbor proper. All this dredging was to a depth of 35 feet at mean lower low water, a total of 1,910,023 cubic yards having been excavated. The completion of the adopted project is urgently required by commercial interests.

On June 30, 1909, the sum of $794,838.79 had been expended, no part of which was for maintenance.

From July 1, 1908, to the cessation of work on December 15, 1908, 208,106 cubic yards of material were removed from the harbor and deposited on shore. A careful survey was later made of the condition of the harbor. This survey showed shoaling to have taken place at the following points: A general shoaling throughout the entrance channel; a noticeable shoaling in the Nuuanu slip at the head of the harbor; a slight shoaling in front of the wharves of the naval station; and very slight shoaling in a few other localities.

The maintenance of this harbor was provided for by the act of March 3, 1909, in accordance with estimate of the Chief of Engineers,

which was printed in House Document No. 1462, Sixtieth Congress, second session.

The approved project is about 49 per cent completed. On June 30, 1909, there was a minimum depth in the entrance channel of about 33 feet; within the harbor proper there was, outside of harbor lines, a general depth of 35 feet. The normal tidal oscillation is about 2 feet. The head of navigation is the head of the harbor, about 2 miles from the Light-House Department buoys marking the entrance to the harbor.

The commerce between this port and ports not in the Hawaiian Islands for the calendar year 1908 amounted to approximately 600,000 tons, valued at $41,562,840. The commerce with other ports of the Hawaiian Islands amounted to 320,158 tons, valued at about $22,000,000.

What effect the improvement of the harbor has had upon freight rates can not be stated, but vessels are now able to enter and leave the harbor with their full-load draft.

Should additional appropriations be made for this harbor, it is proposed to expend the funds in widening the harbor in pursuance with the approved project, so as to make it possible for vessels to enter and leave at all hours of the day and night, instead of by daylight only, as at present.

July 1, 1908, balance unexpended	$368,396.35
June 30, 1909, amount expended during fiscal year, for works of improvement	363,227.14
July 1, 1909, balance unexpended	5,169.21
July 1, 1909, outstanding liabilities	.50
July 1, 1909, balance available	5,168.71
Amount (estimated) required for completion of existing project	828,894.60
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	500,000.00

KAHULUI HARBOR, ISLAND OF MAUI, HAWAII.

Report on a recent survey is printed in House Document No. 593, Sixty-first Congress, second session.

The Chief of Engineers, in submitting the following report of the Board of Engineers, says:

I concur in the recommendations of the Board of Engineers for Rivers and Harbors, with the understanding that the limited project recommended is tentative in character and that extension of the jetty to full length, as proposed by the district officer and at the cost estimated by him, may be necessary in the future to properly protect the harbor.

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., January 17, 1910.

Respectfully returned to the Chief of Engineers, U. S. Army.

The district officer presents within, for consideration, four projects for the improvement of Kahului Harbor, referred to as Nos. 1, 2, 3, and 4, and he recommends for adoption No. 3, which is a tentative project. This project is somewhat indefinite, both as to cost and the location of the eastern line, shown on accompanying map as B–C. The district officer submits, however, an approximate estimate in the sum of $600,000, with $20,000 annually for maintenance, and expresses the opinion, in which the division engineer concurs, that the locality is worthy of improvement to this extent.

The work involved in this project is an extension of the existing breakwater about

400 feet to American Girl Rock, at an estimated cost of $104,500; a further extension of about 600 feet to point K (on map), at an estimated cost of $252,000, making the total estimate for breakwater extension $356,500; a somewhat indefinite amount of dredging and rock excavation on the eastern side of the harbor to a line to be determined later between B–C and N–O; and some dredging on the western side of the harbor. He also thinks that a possible extension of the breakwater beyond the point K may prove desirable and might be accomplished within the limits of the estimated cost of the project by diminishing the amount of the dredging.

The district officer discusses in considerable detail the question of the extension of the breakwater, and concludes, for reasons given, that its extension to American Girl Rock would give comparatively little increased protection and that it should be carried at least to the point K. Local and navigation interests are of opinion that sufficient protection will be afforded if the extension were carried to American Girl Rock. While the Board is inclined to concur in the views of the district officer, it is obvious that it would be in the interest of economy to postpone the construction beyond American Girl Rock, which is very expensive, until experience has demonstrated its necessity. It is apparent also that it would be in the interest of economy not to carry the rock excavation any closer to the line B–C than is necessary, having due regard to the protection to be afforded under the breakwater.

After a careful study of the problem and consultation with representatives of local as well as maritime interests concerned, the Board recommends the following project:

(*a*) Extend the breakwater to American Girl Rock.

(*b*) Dredge to a depth of 35 feet the area in the eastern part of the harbor to a line about 68 feet from and parallel to the bulkhead line B–C. This will require the change of the bulkhead line by that amount.

(*c*) Dredge to a depth of 35 feet the area in the western part of the harbor to a line about midway between the lines R–E and R–Q.

While no precise estimate of the cost of this work can be given, it should not exceed, on the basis of the figures given by the district officer, $375,000.

The Board believes the locality worthy of improvement to this extent and recommends the adoption of the above project at an estimated cost of approximately $375,000, subject, however, to the condition that the Kahului Railroad Company cede to the United States, free of cost, any rights it may have in the existing breakwater, and agree to make no claim for reimbursement for work done by it in constructing the breakwater or in improving the harbor. It appears that the railroad company is prepared to comply with this condition.

There has been submitted to the Board a copy of an agreement between the railroad company and the territorial government, covering the construction and operation of a wharf and wharf shed, which appears to properly provide for its use by the general public. The Board recommends that this agreement be extended so as to provide that the plans to be adopted shall include a public street of proper width giving access to the wharf, and in order to provide the necessary space has recommended the dredging only to a line 68 feet from the present harbor and bulkhead line as above noted. The agreement should also be modified so as to apply to the new line in the same manner as it now does to the line B–C.

In compliance with the provisions of section 13 of the act of March 3, 1909, the Board further reports that neither the establishment of terminal facilities, the development and utilization of water power for industrial and commercial purposes, nor any other subjects not considered within, are so related to the project for improvement of navigation at this locality as to be coordinated in a logical and proper manner with such project to lessen the cost thereof and to compensate the Government for expenditures made in the interest of navigation.

For the Board:

WM. T. ROSSELL,
Colonel, Corps of Engineers,
Senior Member of the Board.

HARBOR AT SAN JUAN, PORTO RICO.

This harbor has a large area, but prior to work under the existing project a small portion had sufficient depth for modern shipping. With the exception of a small area in the bend around La Puntilla, which had a depth of 30 feet, the available depths varied from 20 to 30 feet. All of these depths are referred to mean low water. The usual range between high and low water is about 1 foot. The existing

project adopted by the river and harbor act of March 2, 1907, is to dredge an entrance channel 600 feet wide from deep water outside to a point opposite Morro Point; 500 feet wide from there to La Puntilla, both to be 30 feet deep, and both to be widened where they make the turn around these points; and to dredge, east of La Puntilla, harbor areas amounting to 398,600 square yards to a depth of 30 feet and 70,200 square yards to a depth of 24 feet, all in accordance with House Document No. 914, Fifty-ninth Congress, first session.

The estimated cost of this improvement is $757,500, of which the act of March 2, 1907, appropriated $157,500, and authorized continuing contracts for prosecuting the project in the sum of $600,000. Of this amount the sundry civil acts of May 27, 1908, and March 4, 1909, appropriated $220,000 and $300,000, respectively, leaving $80,000 to be appropriated.

The amount expended on the existing project up to June 30, 1909, is $315.636.54 for improvement.

Work has been carried on under continuing contract at a cost of 19 cents per cubic yard (scow measurement) for soft material and $6.80 per cubic yard (place measurement) for coral rock, and under supplemental contract, entered into February 6, 1909, whereby the contractor was granted permission to dump in a remote portion of the harbor, at a reduction in price of 5 cents per cubic yard for soft material and 30 cents per cubic yard for coral rock, when weather conditions were such as to render it unsafe for the scows to be towed to sea.

There have been removed during the last fiscal year 1,025,322 cubic yards of soft material and 8,048 cubic yards of coral rock. Of these amounts 209,259 cubic yards of soft material were dumped under the supplemental contract at a saving in cost of $10,462.95.

The result of the work has been to practically complete the areas authorized east of La Puntilla (inner harbor); to nearly complete the widening of the entrance channel at La Puntilla—only a small portion next to the point, consisting largely of coral rock, remains; and to commence work on the inner end of the entrance channel. The contractor has also done a large amount of the necessary drilling on one coral-rock shoal at the outer end of the entrance channel. This work gives much relief in the harbor proper and around the difficult turn at La Puntilla, but the draft that can be carried into the harbor is still limited to 27 feet in the entrance channel which is now being dredged. This depth will accommodate any commercial vessel entering San Juan Harbor, but they need more width, which the project will amply provide.

No work was done by the United States prior to this project, but some dredging was done by the Spanish Government.

The amount estimated that can be profitably expended for works of improvement during the fiscal year ending June 30, 1911, will be expended in continuing dredging under the contract, which work is necessary to make the improvement available. In the eighteen months between the completion of the inner harbor and final completion of the contract there will undoubtedly be some fill, especially around La Puntilla. When the contractor removes his plant, there will be nothing left nearer than the United States or Cuba that can handle such work, and any fill which may occur meantime should

be removed before the plant gets away; hence the $20,000 for maintenance.

Commercial statistics, as given in the appendix, were furnished by the custom officials in San Juan, and are given in money value only.

July 1, 1908, balance unexpended		$303,341.25
Amount appropriated by sundry civil act approved March 4, 1909		300,000.00
		603,341.25
June 30, 1909, amount expended during fiscal year, for works of improvement		241,477.79
July 1, 1909, balance unexpended		361,863.46
July 1, 1909, outstanding liabilities		48,000.00
July 1, 1909, balance available		313,863.46
July 1, 1909, amount covered by uncompleted contracts		313,863.46
Amount (estimated) required for completion of existing project		80,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, exclusive of the balance unexpended July 1, 1909:		
For works of improvement	$80,000.00	
For maintenance of improvement	20,000.00	
		100,000.00

EXPENSES OF MEETING OF PERMANENT INTERNATIONAL ASSOCIATION OF NAVIGATION CONGRESSES.

The following is from the report of the House committee:

It is expected to hold the twelfth meeting of the congresses in the United States, and this appropriation is intended to cover the necessary expenses connected with such meeting, which in the cases of meetings abroad have been provided for by the Government issuing the invitation for the meeting. The average of recent appropriations abroad for the meeting, plus expenses borne by the Government concerned, has exceeded the appropriation herein made, the appropriation for the last congress at St. Petersburg being approximately $45,000. The payment of expenses of American members of the association has been confined to those of delegates, of which the number is limited, and the expenses of foreign members to be paid by the United States have been limited to actual cost of transportation on inspection trips in this country, since at the meetings abroad this part of the expenses of the American delegates has been provided for by the entertaining Government. It is expected that the appropriation will not be sufficient to cover all the expenses of the meeting, and substantial contributions will have to be made by the members of the association.

APPENDIX.

ANACOSTIA RIVER, DISTRICT OF COLUMBIA.

The following is from House Document No. 87, Fifty-fifth Congress, third session, and is also printed in Report of Chief of Engineers for 1899, part 2, page 1443

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 12, 1898.

SIR: I have the honor to submit the accompanying report of December 1, 1898, with maps, by Lieut. Col. Chas. J. Allen, Corps of Engineers, of a survey of Anacostia River with project for improvement, etc., made to comply with requirements of joint resolution of Congress approved April 11, 1898, as follows:

"That the Secretary of War be, and he is hereby, directed to prepare and submit to Congress forthwith a project for the improvement of the Anacostia River and the reclamation of its flats from the line of the District of Columbia to the mouth of said river, with an estimate of the cost of the same and a report on the area and ownership of the land to be reclaimed, and, if any portion of said land is vested in private persons, an estimate of the cost of acquiring the same."

Lieutenant-Colonel Allen states that, taking the present plan for a depth of 20 feet in the Potomac as a basis, the necessary ruling depths for navigation of the Anacostia, considered in his report, are 20 feet at low water from the mouth of the river to the navy-yard, with a width of 400 feet; thence to Benning Bridge, a depth of 16 feet, with widths of 200 to 300 feet; and that, as the flats above Benning Bridge are beyond the city limits, their improvement might be deferred and attention be given for the present to the portion of the river in front of the city, where interests of the city and of the United States Government are concerned.

Two projects for improvement from the District line to the mouth, with estimate of cost by sections, are presented.

1. Dredging channel and depositing material to an average elevation of 7 feet above low tide, including construction of sea wall and embankment to a height of 14 feet above low tide; estimated to cost, including contingencies:

Section 1. From mouth to Navy-Yard Bridge	$1,218,525
Section 2. From Navy-Yard Bridge to Benning Bridge	976,195
Section 3. From Benning Bridge to the District line	644,600
Total	2,839,320

If the embankment and drainage be omitted, the total of this estimate will be reduced to $2,493,480.

2. Dredging channel and depositing dredged material on the flats and transporting material to raise the flats to a height of 14 feet above low tide, including sea wall; estimated to cost, including contingencies:

Section 1. From mouth to Navy-Yard Bridge	$3,291,750
Section 2. From Navy-Yard Bridge to Benning Bridge	2,646,930
Section 3. From Benning Bridge to the District line	1,028,500
Total	6,967,180

Assuming that the high-grade filling, although more desirable, would probably not be undertaken on account of its great cost, and that improvement of the river above Benning Bridge may be deferred for the present, Lieutenant-Colonel Allen suggests the improvement of sections 1 and 2, including reclamation of the flats within these sections, estimated to cost $2,194,720, as the plan probably serving present needs

and as the least expensive; the flats within those sections to be raised to a height of about 7 feet above low tide and as specified in estimate No. 1; the channels excavated to afford ruling depths of 20 feet at low tide from the mouth to the navy-yard, and of 16 feet thence to Benning Bridge, with widths as indicated above.

The estimates for this work have been made upon the assumption that large and continuous appropriations will be made so as to permit rapid and uninterrupted work, and it is estimated that $400,000 can be advantageously expended annually under the minimum plan (estimated cost, $2,194,720).

The estimates presented do not include the cost of alteration of bridges which would be necessitated by the improvement, nor the cost of protection of bridge piers which may be affected by excavation so near them.

A list of lands within the limits of the proposed improvement, with names of owners and assessed value thereof, accompanies this report, and Lieutenant-Colonel Allen states that it has not been practicable to obtain any estimate of the cost of acquiring the lands other than that which may be indicated by their assessed values.

I concur in the views of Lieutenant-Colonel Allen and commend this important work to the favorable consideration of Congress.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brigadier-General, Chief of Engineers, U. S. Army.

Hon. R. A. ALGER.

The following is printed in House Document No. 903, Fifty-ninth Congress, first session:

EXECUTIVE OFFICE,
COMMISSIONERS OF THE DISTRICT OF COLUMBIA,
Washington, June 21, 1906.

SIR: The Commissioners of the District of Columbia have the honor to submit the following report upon the improvement of the flats of the Anacostia River, in pursuance of the following House concurrent resolution (No. 21, passed February 27, 1906):

"*Resolved by the House of Representatives (the Senate concurring)*, That the Commissioners of the District of Columbia be, and they are hereby, authorized and directed to submit to Congress a report upon the improvement of the so-called flats of the Anacostia River, from its mouth to the District line, with recommendations and estimates of cost."

This report is based mainly on information that has already been collected.

By joint resolution of Congress approved April 11, 1898, the Secretary of War was directed to prepare and submit to Congress a project for the improvement of the Anacostia River and the reclamation of its flats, from the District line to the mouth of the river, with an estimate of cost and a report on the area and ownership of the land to be reclaimed, and the resolution provided that if any portion of said land was vested in private persons an estimate should be made of the cost of acquiring the same.

This report was made under date of December 14, 1898, and is printed as House Document No. 87, Fifty-fifth Congress, third session.

In this report two projects were considered for the improvement of the river from the District line to its mouth. The first project provided for dredging a channel and depositing material to an average elevation of 7 feet above low tide, including the construction of a sea wall and embankment to a height of 14 feet above low tide. The estimated cost was as follows:

Sec. 1. From mouth to Navy-Yard Bridge	$1,218,525
Sec. 2. From Navy-Yard Bridge to Benning Bridge	976,195
Sec. 3. From Benning Bridge to the District line	644,600
Total	2,839,320

The second project provided for raising the flats to a height of 14 feet above low tide. The cost of this was estimated at $6,967,180.

The War Department assumed that this second project, on account of its great cost, would not be undertaken, and also believed that the improvement of the river above Benning Bridge might be deferred.

In the above estimate it was proposed to excavate channels to afford ruling depths of 20 feet at low tide from the mouth to the navy-yard, with a width of 400 feet, and of 16 feet from the navy-yard to Benning Bridge with a width of from 200 to 300 feet. The above estimates do not include the cost of alterations of bridges nor the protecting of bridge piers which might be affected by excavations made near them.

Upon inquiry at the office in charge of the Potomac River improvements, it is found that the foregoing estimates, although made in 1898, are correct as of this date, but that they are based on the assumption that large and continuous appropriations

will be made, as dredging under small annual appropriations costs more than if larger sums were authorized for the work.

In the appropriation act of July 1, 1902, the following provision was contained:

"Anacostia River flats: For a survey and outline map of land owned by the United States, comprised within what is known as the flats of the Anacostia River, from its mouth to the boundary line of the District of Columbia, five thousand dollars, or so much thereof as may be necessary, to be expended under the direction of the Secretary of War, and the Attorney-General is authorized and directed to examine and report upon the nature of the title to lands embraced within said flats."

The report and maps made in pursuance of this provision of law were printed as House Document No. 194, Fifty-ninth Congress, first session. They included only those reservations actually belonging to the United States. As to the ownership of the flats proper or the submerged land the Attorney-General made the following report, which is also printed in the document above referred to:

"I have the honor to return herewith an outline map in five sheets, and other papers, relating to a survey lately made by the Engineer Department of lands owned by the United States within what is known as the flats of the Anacostia River from its mouth to the boundary line of the District of Columbia; all of which papers were transmitted hither by your department for examination and report "upon the nature of the title to lands embraced within said flats," in compliance with the act of July 1, 1902.

"The title of the United States to the premises under consideration is derived from the same source and is of the same nature as its title to what is known as the Potomac flats, which has been judicially established. (See Morris *v.* United States, 174 U. S., 196.) It rests upon the cession made by the act of the State of Maryland of December 23, 1788, entitled "An act to cede to Congress a district 10 miles square in this State," which was accepted by the act of Congress approved July 16, 1790, and the act of March 3, 1791, amendatory thereof, and was subsequently ratified by an act of the State of Maryland, passed December 19, 1791. By this legislation the United States became invested with the title to the shores and beds of the navigable waters within the limits of the territory so ceded, embracing the Eastern Branch, or Anacostia River, as it was then navigable, as well as the Potomac River, which title was held by the United States (as it previously was by the State) in trust for public purposes.

"The lands included within the Anacostia flats, as shown by the said survey, appear to be either submerged or subject to tidal overflow by the waters of the Eastern Branch, and are a part of the bed of the latter. The accompanying papers furnish no information as to the existence of any private claims affecting these lands. It is probable, however, that claims to riparian rights and wharfing privileges do exist on the part of owners of property fronting on the Eastern Branch; and the Baltimore and Potomac Railroad Company, whose tracks cross the flats in question, may have claims in connection with its right of way upon the same. Subject to the existence and validity of such claims, if any, I think that the ownership of all the land embraced within what is known as the Anacostia flats, as indicated by the aforesaid survey, is vested in the United States for public purposes."

The question as to the ownership of the riparian rights and of part at least of the submerged land is therefore still unsettled. Attention is respectfully invited to these reports for the detailed estimates.

The work done on the Anacostia River by the United States within the last few years, and which consisted in dredging below the Navy-Yard Bridge, amounted to about $170,000, and resulted in giving a channel 20 feet deep and 300 feet wide, the dredged material being deposited on the sides. Harbor lines have been established as far as the Pennsylvania Avenue Bridge.

The foregoing includes in brief the reports made and the work done by the United States in connection with the reclamation of the Anacostia flats.

The subject of the treatment of the Anacostia River and flats was taken up by a commission appointed March 1, 1901, by the United States Senate to report on a park system for the District of Columbia. In this report they recommended generally the treatment of the lower portion of the river as had been recommended by the War Department, but suggested that on the line of Massachusetts avenue, or at the Benning Bridge, a dike should be built across the river having tidal gate connection with the lower part and that the part above this dike should be treated as a pleasure park. It was proposed to dredge to the depth of 12 feet and to form numerous islands with a portion of the dredged material. The portion of this material not needed for the park purposes was to be used to fill up the submerged land in what was intended to be the commercial section of the river below this dike.

The area of this proposed park above Massachusetts avenue would be about 1,100 acres, of which one-half would be land and one-half would be clear water, suitable for boating and bathing. The cost of the project, including dike and dredging, and

exclusive of the cost of the land, would be about $1,000,000, so that the total cost would be about the same as the estimated cost of the War Department project—about $3,000,000. This does not include development of the park with roadways, etc.

This proposed dike forming the lake could be placed at Massachusetts avenue or at Benning Bridge, or at any other desirable point. The lower location will diminish the amount of dock frontage and will make, on account of the present location of the Pennsylvania Railroad bridge crossing the stream, a difficult matter to avoid a grade crossing.

A location of the dike at East Capitol street would probably be a very satisfactory solution. The dike would form a street across the river at the lower end of the park.

The Pennsylvania avenue highway bridge and the Pennsylvania Railroad bridge should be rebuilt in such a manner as to allow the passage of vessels.

It is practically impossible to estimate with any degree of accuracy the cost of the project until the value of such land not now belonging to the United States as may be found to be necessary and the value of the riparian rights of private owners are determined.

In the report of the War Department made in 1898, the assessed value of what was considered private land was put at about $23,000, but there can be no question that the value as determined by a jury will be many times greater. The value of the riparian privileges may be very small, on account of the shallowness of the stream and the present nonavailability for commercial purposes; but, on the other hand, it may amount to a million dollars or more.

To offset this cost there will be in the commercial section a filling in of 600 or more acres of land, which, if the riparian rights are obtained, will belong to the United States, and can be utilized either as a park or sold for commercial use. This will offset, to a considerable extent, the cost of the project, and if it is leased will doubtless give an adequate return on the money spent.

Within any reasonable cost, and it is thought that three or four million dollars is reasonable, the desirability of this improvement is extremely great. The land now available for wharfage facilities in Washington is too limited and the wharf frontage is now already crowded. To carry out the project would quadruple the water front along a navigable channel.

The most important phase of the matter, however, is the improvement in sanitary conditions which would result. The Anacostia flats are exposed at low tide and the marshes which they form are breeding places for mosquitoes and lodging places for sewerage and filth and disease-breeding germs. The appearance of the flats at low tide is unsightly and the odors from them are disagreeable. Due to the gradual accumulation of earth along the shores and the narrowing of the mouth of the river by accretion, the building of several bridges, the depositing along the sides of the river of dredged material, the construction of the outfall sewer, and other reasons, the situation is becoming worse, and the size of the flats uncovered at low tide and the extent of the marshes are increasing, while the flow of tide water is decreasing.

These conditions form a very serious menace to the health and comfort of the residents and also to the development of this section of the city, and to a less extent of the whole District of Columbia. Early action by Congress toward adopting a project for the improvement of these flats, therefore, is recommended by the commissioners. Some steps should first be taken to determine the title to the submerged land and the riparian rights. This can be done by directing the Attorney-General of the United States to bring suit against all parties claiming land or riparian rights along the stream, such as was done in the case of the Potomac flats, or by authorizing the commissioners to employ counsel to thoroughly investigate the question. The commissioners understand that the matter of these titles was investigated to some extent in the Potomac-flats case, and they believe that much information can be obtained by employing the counsel engaged under that case to investigate and report on the character and title to the lands included in the Anacostia flats and along the Anacostia River. It is believed by adopting the latter method an intelligent knowledge on the subject upon which future action could be taken would be obtained, and in addition it is believed that this method would be more prompt and efficacious, and might avoid the necessity of a suit.

The commissioners, therefore, as a first step to be taken, would recommend an appropriation of $10,000 to employ counsel to investigate and determine as far as possible as to the ownership of the land and riparian rights along the Anacostia River, and after this is known to prepare a plan for improvement, or if ownership and rights can not be thus ascertained, that the Attorney-General be directed to bring suit for the purpose.

Very respectfully,

HENRY B. F. MACFARLAND,
President Board of Commissioners District of Columbia.

Hon. JOSEPH G. CANNON,
Speaker of the House of Representatives.

ARKANSAS RIVER, ARKANSAS, OKLAHOMA, AND INDIAN TERRITORY, UP TO MUSCOGEE, IND. T.

Report on examination is printed in House Document No. 71, Sixty-first Congress, first session. (See also p. 437.)

Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, June 21, 1909.

SIR: Section 1 of the river and harbor act approved March 2, 1907, contains an item as follows:

"Improving Arkansas River, Arkansas: * * * The Secretary of War may appoint a board to make an examination of said river to Muscogee, Indian Territory, with a view to ascertaining whether any feasible or desirable plan can be devised for the further improvement of the whole of said river to Muscogee or any portion thereof. The said board may, upon the order of the Secretary of War, also make a similar examination of that portion of the Red River which lies between Fulton, Arkansas, and the mouth of the Washita River, Indian Territory, and the expense of such examination shall be apportioned between the funds appropriated for said rivers in such a manner as the Secretary of War may deem equitable, and the said board shall also report upon the Arkansas River at Pine Bluff and the White River at Augusta Narrows to ascertain and report whether the protection of the banks or rectification of the river at the points named is directly and necessarily required in the interests of navigation, and in case a report shall be made to the effect that such rectification is so required in the interest of navigation the sum of one hundred thousand dollars, which is hereby conditionally appropriated, shall be expended for improvements at the places named, or either of them."

In conformity with this provision of law and with the authority of the Secretary of War a Board of Engineer officers was duly appointed, which submitted a partial report under date of May 27, 1907; to complete the unfinished work of this Board, a second board was appointed, whose report was submitted under date of March 27, 1909. Both of these reports were referred, as required by law, for review and recommendation by the Board of Engineers for Rivers and Harbors, constituted under authority of section 3 of the river and harbor act, approved June 13, 1902, and by this permanent Board three reports have been submitted, dated, respectively, June 10, 1907, December 30, 1907, and April 12, 1909. All the reports mentioned are herewith. For the sake of convenience, the various matters treated therein will be considered separately.

Arkansas River from the mouth to Muskogee.—Arkansas River is at present being improved by snagging and dredging, assisted by contraction and revetment works, with a view to aiding open-river navigation. Further improvement can be effected by more extensive operations of the same nature, by the construction of locks and dams, or by a combination of the two methods. In the report of May 27, 1907, by the special Board, the opinion is expressed that the only way in which a radical and permanent improvement of the river can be obtained is by constructing locks and dams from Muskogee to Little Rock and providing open-channel navigation from Little Rock to the mouth by means of dredging done in connection with extensive bank revetment. While this project is considered entirely feasible, in the opinion of the Board, it is not at this time desirable on account of its great cost and the length of time required to complete it. On the other hand the Board deems it both feasible and desirable to obtain a considerably improved channel over a longer period of navigation for the entire section of river from Muskogee to the mouth by means of hydraulic dredging. To expect any marked success from this method of improvement the Board deems it essential that an adequate plant be provided from the start and that such plant should consist of 5 hydraulic dredges. In the event of the adoption of this or any other method of improvement the Board also considers it important that the snagging operations of the present project be continued, and that they be extended up to Muskogee, and for this work is proposed a new steel hull snag boat in addition to the two boats now in use. The 5 dredges are estimated to cost $150,000 each, or $750,000, the new snag boat $50,000, making the total first cost of the plant $800,000. The annual cost of maintenance and operation of the plant is estimated at $50,000 for each dredge and $25,000 for the snag boat, or a total annual maintenance charge of $325,000 for operating the 5 dredges and 3 snag boats. The Board states further that in addition to the snagging and dredging it may be necessary at certain localities to resort to the use of contraction works, to closing subsidiary channels, and to revetting caving banks; but, without giving an estimate, the belief is expressed that the

amount and cost of such work will not be sufficient to affect the desirability of undertaking the improvement at first by dredging alone.

In its review of this report of the special Board, the Board of Engineers for Rivers and Harbors, under date of December 30, 1907, expresses the belief that any improvement which Congress may decide to authorize for the Arkansas River should be along the lines recommended by the special Board, but points out that the channel depths may prove inadequate, that the results will be temporary rather than permanent, and that when measured by the standards which have been applied to other projects of similar nature, the expenditure involved in improving the entire river appears to be out of proportion to the benefits to be derived. The permanent Board proposes, therefore, that the improvement be initiated tentatively by the construction and operation of only such plant as may be needed for that part of the river below Little Rock, leaving the question of extending operations above that point to be determined in the light of the experience so gained. This plan involves the use of two dredges at an estimated first cost of $300,000 and $100,000 per annum for maintenance, in addition to any work of snagging that may be found necessary.

Some experimental dredging has been done on the Arkansas, and while as yet unprepared to advocate the adoption of this means of improvement for the entire section of river under consideration (i. e., from the mouth up to Muskogee), the Chief of Engineers believes it worthy of further trial below Little Rock and recommends for adoption the tentative plan proposed by the Board of Engineers for Rivers and Harbors.

Red River between Fulton, Ark., and the mouth of the Washita River.—The river and harbor act approved March 3, 1905, authorized the expenditure of $100,000 in the improvement of Red River between Fulton, Ark., and Denison, Tex., a distance of 281 miles, the latter point being 11 miles below the mouth of the Washita River. The work being done under this appropriation consists in the removal of snags, logs, and drift, the cutting of timber on caving banks, and in closing chutes and cut-offs where necessary.

At the time of reporting on the Arkansas River the two boards above referred to were unable to render an opinion as to the feasibility or desirability of the further improvement of this section of the Red River on account of the lack of sufficient information, and a survey was ordered to furnish the necessary data. This survey was made during the summer of 1908 by the local engineer officer, Capt. A. E. Waldron, Corps of Engineers, who submitted a preliminary report September 29, 1908, and a final report (with maps) on January 16, 1909. These reports are appended to the report of a special board convened to comply with the terms of the law, and are also herewith.

In its report of March 27, 1909, this second special Board finds that the only form of radical and permanent improvement for the upper Red River which could be entered upon with the prospect of ultimate success is by the use of locks and dams, supplemented by extensive works for bank protection and channel regulation, dredging, etc. In the opinion of the Board the cost of such improvement would be far beyond the value of any probable benefits to be secured thereby, and therefore improvement of the river to this extent, while feasible, is not regarded as desirable. The Board, however, believes it to be both feasible and desirable to continue the improvement of Red River above Fulton to the mouth of the Washita substantially in accordance with the present project, with the addition of a small amount of dredging. The cost of the work proposed is estimated at $160,000 for the first two years and $50,000 a year for maintenance thereafter.

The views and recommendations of this special Board are concurred in by the Board of Engineers for Rivers and Harbors in its report of April 12, 1909; they also meet with the approval of the Chief of Engineers.

Arkansas River at Pine Bluff and White River at Augusta Narrows.—In compliance with the further provision of law as quoted above, the first special Board and the Board of Engineers for Rivers and Harbors gave consideration to the question of bank protection and channel rectification of the Arkansas River at Pine Bluff and White River at Augusta Narrows, and in their respective reports of May 27, 1907, and June 10, 1907, these boards expressed the opinion that in each case the work indicated was required in the interests of navigation. In view of these favorable reports the $100,000 conditionally appropriated became available, and, with the authority of the Secretary of War, was applied to the improvement of these localities. The work at Pine Bluff was damaged by high water in the late fall and early winter of 1908 and is now being repaired with funds provided by Congress. The work at Augusta Narrows is completed.

I have the honor to recommend that the accompanying reports be transmitted to Congress.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

ARCADIA HARBOR, MICHIGAN.

Report on a recent survey is printed in House Document No. 321, Sixty-first Congress, second session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., August 30, 1909.

Respectfully returned to the Chief of Engineers, U. S. Army.

This harbor was originally improved by private enterprise by dredging a channel of entrance and protecting it with slab revetments and piers. An estimate of cost of maintaining the piers and channel was called for by the act of June 13, 1902. The piers were found to be in very bad condition, and that to maintain them in a manner to effectively protect the channel would require practically their reconstruction at an estimated cost of $90,390. It was estimated that after reconstruction an annual outlay of about $2,700 would be required for their maintenance, and the cost of maintaining the channel by dredging was placed at $2,500.

These expenditures were deemed excessive when compared with existing and reasonably prospective commerce, and were not recommended. In view, however, of the expenditures made by private interests and the prospect of some increase in commerce, it was recommended that the channel be maintained by the United States by dredging for a period of five years at an annual cost of $3,000, and that the question of further work be then determined. Beginning with 1905, appropriations aggregating $15,000 have been made, with which the channel has been dredged to a depth of 12 feet from time to time.

The object sought by the present investigation is stated to be the continuance of the improvement and the enlargement of its scope so as to provide a deeper and wider channel and to extend and repair the piers and revetments. The work reported as in bad condition in 1902 must have further deteriorated since that time, and it is obvious that to create and maintain a reliable channel would require extensive and costly repairs and extensions.

The commerce of this harbor has never been large, and even though it may have increased in recent years, it is still comparatively small and of almost insignificant proportions when compared with the probable cost of creating a reliable channel of sufficient capacity to meet the increasing demands of modern lake vessels.

While the commercial ststistics do not appear to be complete or entirely satisfactory, a most liberal allowance for errors and inaccuracies would still indicate that the amount of water-borne commerce is insufficient to justify a continuance of the expenditures made by the General Government during the past five years, and it is obvious that much larger sums will be required in the future if an effective channel is to be maintained.

In view of the foregoing and the fact that the United States has at considerable expense provided two first-class harbors within 9 and 10 miles, respectively, of Arcadia, the Board expresses the opinion, concurring with the district officer and division engineer, that Arcadia Harbor is not worthy of improvement by the General Government.

Interested parties were notified of the district officer's adverse report and advised that they might, if they desired, submit their views to the Board. Several communications received have been given consideration.

An extended hearing was given to gentlemen from the vicinity of the proposed improvement which satisfied the committee that the prospective commerce of the locality amply justifies the proposed improvement.

ASHTABULA HARBOR, OHIO.

Report on a recent survey is printed in House Document No. 654, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers, submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, February 4, 1910.

SIR; I have the honor to submit herewith for transmission to Congress reports dated April 15, 1909, and January 20, 1910, with map, by Lieut. Col. John Millis, Corps of Eng neers, on preliminary examination and survey, respectively, called for by the

river and harbor act approved March 3, 1909, of Ashtabula Harbor, Ohio, with a view to enlarging and improving the outer harbor area.

The existing project, adopted in 1896, provided for the construction of two detached breakwaters, the west one 1,800 feet long and the east one 1,200 feet long, and also of two pierhead cribs. In 1905 an extension of the west breakwater to a point at or near the shore was authorized. The approved project also includes the maintenance of channels and sheltered area at a depth of 20 feet by dredging and repairs to existing works. The project is regarded as 95 per cent complete.

Some work of improvement has been done in this harbor by private interests, such as the removal of the old west jetty and the extension of the east breakwater about 1,000 feet toward the shore.

The district officer submits a plan for further improvement, shown in detail on the map, as follows: Extension of the west breakwater about 1,700 feet toward the shore marked "A;" extension of the west breakwater into the lake 1,700 feet, terminating it with a pierhead marked "B;" removal of 600 feet of the outer end of the present east breakwater marked "C;" construction of a new easterly breakwater beginning at a distance of 600 feet from the outer end of B extending 1,800 feet eastwardly marked "D," with an arm 2,700 feet long extending toward the shore marked "E;" removal of such additional part of the inner east breakwater "C" as may be found necessary; all the new breakwaters proposed are of rubble mound construction of design similar to that used for the recent work of similar character in this vicinity, except that a reduced section is proposed for the shore extension of the west breakwater. He estimates the cost of this improvement to be $1,385,529, and that the amount of maintenance necessary to be done by the United States will not exceed $5,000 per annum.

I concur with the division engineer and Board of Engineers for Rivers and Harbors in the opinion that this locality is worthy of further improvement by the General Government to the extent proposed, but I consider that the details of the work should be subject to such minor modifications as may appear necessary or desirable during the execution of the project.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

ATCHAFALAYA RIVER, LOUISIANA.

Report on a recent survey is printed in House Document No. 669, Sixty-first Congress, second session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., February 1, 1910.

Respectfully returned to the Chief of Engineers, U. S. Army.

In its indorsement of November 22, 1909, reviewing the report of the district officer on preliminary examination of this locality, the Board briefly described existing channel facilities and expressed the opinion that a greater depth of water than that now available would be of great benefit to general commerce and navigation, and that it would be advisable for the General Government to enter upon a project for opening this waterway to the public if the cost is not excessive, and if satisfactory arrangements could be made by which the company now controlling the canal between Atchafalaya Bay and the Gulf would cooperate with or assign its interests to the United States.

In his report on the survey the district officer gives consideration to the questions mentioned above and submits an estimate of cost in the sum of $500,000 for excavating a channel 20 feet deep and 240 feet wide, as specified in the act. He also presents several proposals from the Atchafalaya Bay Ship Channel Company, covering the assignment of the ship channel to the United States and its enlargement and maintenance for a period of three years. The proposals are as follows:

Proposal No. 1.—To construct channel 200 feet wide and 20 feet deep, $500,000.

Proposal No. 2.—Same as above, including maintenance of channel for three years for the actual cost thereof, not to exceed $30,000.

Proposal No. 3.—To construct channel 240 feet wide and 20 feet deep, $580,000.

Proposal No. 4.—Same as above, including maintenance of channel for three years for the actual cost thereof, not to exceed $30,000.

Proposal No. 5.—To transfer the present 14-foot channel to the United States for the sum of $150,000, provided the United States will enlarge same to a depth of not less than 20 feet and a width of not less than 200 feet.

The district officer expresses the opinion that the sum of $150,000, for which the United States may acquire the channel of the company, is equitable. It will be seen that the proposals of the company, which include the assignment of the canal, are considerably less than the estimated amount for which the canal can be purchased and correspondingly enlarged by the United States. The proposal of the company in respect to the maintenance of the channel for a period of three years is also believed by the Board to be economical and advantageous to the United States.

Having considered all the information available, the Board has reached the conclusion that it is advisable for the United States to enter upon the improvement of this waterway for the benefit of commerce and navigation, by the acceptance of proposals Nos. 1 and 2, of the Atchafalaya Bay Ship Channel Company, which provide for the assignment to the United States of the existing 14-foot channel of that company, the enlargement of this channel to a depth of 20 feet and width of 200 feet, at a total cost of $500,000, and the maintenance of the same for a period of three years for the actual cost thereof, not to exceed $30,000, subject to such modification of details as may prove necessary, in the judgment of the Secretary of War, when the contract is actually entered into.

The district officer describes existing wharves and terminal facilities, and attention is respectfully invited to his remarks on this subject. In compliance with the provisions of section 13 of the act of March 3, 1909, the Board reports that there are no questions of waterpower, or other subjects so related to the project proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures made in the interests of navigation.

For the Board:

WM. T. ROSSELL,
Colonel, Corps of Engineers,
Senior Member of the Board.

Commercial statistics.—A very elaborate and complete report of the commerce, present and prospective, was submitted with the report of Colonel Ruffner in June, 1908. The report shows that from October 24, 1907, to April 16, 1908, or practically six months, 12,608 tons of lumber, 6,027 tons of oysters, and 4,830 barrels of oil were taken through the channel, amounting in all to approximately 20,000 tons. The period covered by this report was one of great business depression and it is estimated that the annual commerce in normal business years through the channel, if improved, will amount to the following:

	Tons.
Export of cypress lumber to eastern markets, etc., one-third of annual production	200,000
Import of fuel oil	85,000
Export of salt, with completion of inland waterway to Bayou Teche	100,000
Export of sugar to New York	180,000
	565,000

This tonnage is exclusive of other minor products, a large quantity of which would also be carried in or out through the channel.

BOCA GRANDE AND CHARLOTTE HARBOR, FLORIDA.

Following are extracts from House Document No. 76; Fifty-sixth Congress, first session.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, November 24, 1899.

SIR: Among the localities for which provision for examination and survey is made by the river and harbor act approved March 3, 1899, is Boca Grande and Charlotte Harbor, Florida, with a view to obtaining a depth of 24 feet of water over the bar at the entrance of the harbor and 18 feet thence up to Punta Gorda.

The preliminary examination provided for was made under direction of Capt. Henry Jervey, Corps of Engineers, and his report of September 5, 1899, of the results, is submitted herewith. The information secured indicates that while an increased depth over the bar would probably be of material benefit to the commercial interests by enabling vessels to load to their full capacity in the anchorage grounds within the entrance, there is no apparent demand for a deeper channel from the entrance up to Punta Gorda.

The existing project for the improvement, now nearing completion, provides for a mean low-water depth of 12 feet up to a point abreast of the railroad wharf at Punta

Gorda, and a greater channel depth than this could be secured only at an extraordinary cost. Accordingly, the local officer was directed, by authority of the Secretary of War, to prepare and submit a plan and estimate of cost of securing increased depth on the bar, and I have the honor to submit his report of November 3, 1899, presenting such plan and estimate, with map. The improvement proposed is to excavate a channel across the bar 300 feet wide and 24 feet deep (to be dredged to a depth of 25 feet, allowing 1 foot for back filling), at an estimated cost of $140,000. The annual expense for maintenance will probably amount to $1,000.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

PLAN AND ESTIMATE FOR SECURING A DEPTH OF 24 FEET AT MEAN LOW WATER ON THE BAR AT BOCA GRANDE, THE MAIN ENTRANCE TO CHARLOTTE HARBOR, FLORIDA.

UNITED STATES ENGINEER OFFICE,
Tampa, Fla., November 3, 1899.

GENERAL: In compliance with instructions contained in Department letter dated September 21, 1899, I have the honor to submit the following plan and estimate for securing a depth of 24 feet at mean low water on the bar at Boca Grande, the main entrance to Charlotte Harbor, Florida, as proposed in my report of September 5, 1899, upon the preliminary examination of this locality:

Charlotte Harbor lies about 74 miles south of Tampa Bay, and offers the most southerly deep-water harbor on the west coast of the mainland of Florida. The main entrance to the harbor, known as Boca Grande, enters between Gasparilla Island on the north and La Costa Island on the south. It is straight and stable in position and depth, with a depth exceeding 24 feet, except upon two shoals or bars, respectively about 2½ and 3½ miles seaward of the entrance, and upon which the least channel depth is 19 feet at mean low water. The average rise of the tide is nearly 2 feet.

Within the entrance is an anchorage ground with an area of 350 acres and a mean low-water depth of not less than 24 feet, the depth in 250 acres of the area being 27 feet and over. In this anchorage seagoing vessels can generally receive their cargoes from lighters without difficulty.

The preliminary examination referred to was made in accordance with the provisions of section 22 of the river and harbor act approved March 3, 1899, and covered "Boca Grande and Charlotte Harbor, with a view to obtaining a depth of 24 feet of water over the bar at the entrance of the harbor and 18 feet thence up to Punta Gorda."

The information available indicates that, while an increased depth on the bar would probably be a material benefit to commerce by enabling deep-draft vessels to load to their full capacity in the anchorage grounds within the entrance, there is no apparent demand for a deeper channel from the entrance up to Punta Gorda. The existing project for the improvement, now nearing completion, provides a mean low-water depth of 12 feet up to a point abreast of the railroad wharf at Punta Gorda, and a greater channel depth than this could be secured only at an extraordinary cost.

The data for the plan and estimate herein submitted have been obtained from the survey made by Capt. W. M. Black, Corps of Engineers, U. S. Army, in 1890-91, supplemented by the United States Coast Survey charts.

The plan proposed is to form a channel across the bar 300 feet wide and 24 feet deep at mean low water by dredging the shoals as indicated on the accompanying map. The proposed channel consists of two cuts, aggregating 8,583 feet in length, in the same straight line and separated by a pocket of deep water about 2,000 feet across. The depths where dredging is required are generally 19 to 21 feet at mean low water.

The following estimate is based on dredging to a depth of 25 feet, allowing the extra foot for back filling, side slopes of 1 vertical to 3 horizontal (1 on 3), and scow measurement which is assumed to be 25 per cent greater than place measurement.

Estimate of cost.

Dredging 421,484 cubic yards sand and broken shell, at 30 cents	$126,445.20
Engineering and contingencies, about 11 per cent	13,554.80
Total	140,000.00
Annually for maintenance	1,000.00

The dredged channels if quickly made to full dimensions will probably be reasonably permanent and require but little work of maintenance. The observed velocity of currents averages 1 to 1½ miles per hour.

The high unit price estimated for dredging is due to the exposed site and the prevalence of violent winds at certain seasons. Dredging operations can be carried on to the best advantage in the spring and summer months and as late as November.

A map showing the main entrance, the anchorage ground, and the proposed location of the new channel accompanies this report.

Very respectfully, your obedient servant,

HENRY JERVEY,
Captain, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

BOGUE SOUND, NORTH CAROLINA.

Report on a recent survey is printed in House Document No. 649, Sixty-first Congress, second session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., January 28, 1910.

Respectfully returned to the Chief of Engineers, U. S. Army.

In the within report on a survey of Bogue Sound in the vicinity of Morehead City, the district officer submits three plans of improvement, and recommends for adoption plan No. 1, which contemplates the dredging of a channel 10 feet deep at mean low water beginning at a point 2,000 feet westward of Beaufort Harbor and extending up to and along the wharves at Morehead City for a distance of 3,800 feet, the lower 2,800 feet being 100 feet wide, and the upper 1,000 feet 200 feet wide. This plan also provides for the construction of 2,000 linear feet of bulkhead in front of the city, behind which it is proposed to deposit the dredged material. It is also proposed by the district officer, as a condition to undertaking the improvement, that the town or riparian owners convey to the United States, free of cost, title to all land between the proposed bulkhead and the city street along which the railroad is constructed. He suggests that the area thus reclaimed be sold to reimburse the United States for expenditures made on the improvement.

Morehead City is situated at the southern terminus of the approved inland waterway from Pamlico Sound to Beaufort Inlet, which will afford a depth of 10 feet at mean low water. A similar depth is proposed by the district officer for the channel to Morehead City in order that the commerce of the locality may be able to take full advantage of the facilities to be available in the waterway. The commerce involved in the improvement now under consideration is not large, but it is of considerable value and is of a character requiring quick transportation to market. The inadequate depth in the approaches to Morehead City offers no opportunity for the development of traffic, and it appears that the water-borne commerce now existing is carried on under difficulties.

In view of the early completion of the inland waterway referred to above, the Board believes that it is advisable for the United States to construct a channel 10 feet deep affording communication with Morehead City. The cost of the dredging necessary to open such a channel is estimated by the district officer at $19,000. The Board is unable to indorse the proposal of the district officer that the land between the improved channel and the city be deeded to the United States. Except as a place to deposit dredged material during the progress of the work, the area in question is not required by the United States for any public use; on the contrary, its use will be indispensable to local interests upon completion of the improvement to enable them to take advantage of the facilities created. In view, however, of the evident benefits which the reclamation of this area will confer upon local interests, the Board believes that they should be required to construct the bulkhead necessary to retain the excavated material, as has been done at some other localities, and to grant unto the United States the right to deposit dredged material behind the same within the area specified by the district officer.

Under these conditions, the Board recommends the improvement of Bogue Sound, with a view to providing a channel 10 feet deep at mean low water up to and along the wharves at Morehead City, at a total estimated cost of $19,000, and $2,000 annually for maintenance.

The district officer describes existing wharves and terminal facilities, and attention is respectfully invited to his remarks on this subject. In compliance with the provisions of section 13 of the act of March 3, 1909, the Board reports that there are no questions of water power, or other subjects so related to the project proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures made in the interests of navigation, except the construction of the bulkhead referred to within.

For the Board:

W. C. LANGFITT,
Lieut. Col., Corps of Engineers,
Senior Member Present.

The officer in charge of the survey in his report says:

The principal commodities handled by water at Morehead City are fish, oysters, clams, and crabs. The boats which collect these commodities from a distance of 50 to 60 miles on both sides of Morehead City, usually arrive at that place in the afternoon just in time to unload and ship on the afternoon train. If the tide is low, they are unable to reach their wharves, and thus frequently lose a cargo because of lack of cold storage to keep their load until the next day. The proposed improvement will enable them to make sure the daily shipments, as the stage of the tide will not affect their ability to reach the shipping point.

A water transportation line between Newbern and Swansboro now passes by Morehead City and does not stop because of lack of depth of water to reach the wharves. The freight rates to Morehead City are 50 to 100 per cent higher than to Beaufort, 2 miles away, because Beaufort has water facilities and Morehead City has not.

The benefits of this improvement to the fish and oyster industry, those in the way of reducing freight rates and providing better means for water transportation, and those arising from providing facilities at the southern terminus of the proposed inland waterway, where none now exist, are believed to be sufficient to justify the proposed expenditure in accordance with plan 1.

BRIDGEPORT HARBOR, CONNECTICUT.

Following is the letter of the Chief of Engineers, submitting report on a recent survey, printed in House Document No. 751, Sixty-first Congress, second session:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, March 4, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated September 1, 1909, and February 11, 1910, with maps, by Lieut. Col. Harry Taylor, Corps of Engineers, on preliminary examination and survey, respectively, of Bridgeport Harbor, Connecticut, called for by the river and harbor act approved March 3, 1909, with a view to providing increased facilities in Poquonock River and Cedar Creek branches, including a report whether the whole or any part of the cost of improvement thereof should be borne by the General Government.

The river and harbor act of 1899 adopted a project for improvement of this locality, providing for: (1) A channel in Poquonock River, 18 feet deep, 300 feet wide from the outer bar to the inner beacon, thence 200 feet wide to the lower or Stratford Avenue Bridge. (2) Three anchorage basins: One adjoining the main channel on the west, above the inner beacon, 18 feet deep, 500 feet wide, and 2,000 feet long; one adjoining the main channel on the west, between the 18-foot anchorage and Naugatuck wharf, 12 feet deep, 500 feet wide, and 900 feet long; and one on east side of channel between the steel works point and the lower bridge, 12 feet deep. (3) A channel in the Poquonock River from the lower bridge to the head of navigation, about 1 mile, 12 feet deep and 100 feet wide. (4) A channel in Yellow Mill Pond from the main channel to the head of the pond, about 1 mile, 12 feet deep and 100 feet wide. (5) A channel in Johnsons River from the main channel to the head of navigation, about 1¼ miles, 9 feet deep and 100 feet wide. (6) A channel 9 feet deep and 100 feet wide from the head of Black Rock Harbor to the junction of Cedar and Burr creeks, thence up each of these creeks to the head of navigation, with lengths, respectively, of 1⅓ miles and ½ mile. (7) The repair and maintenance of the outer and inner breakwaters of the main channel and the one connecting Fayerweather Island with the mainland, and the construction and maintenance of shore protection on Fayerweather Island to check the shifting of the beach.

This project was completed in 1907, except a section of Burr Creek, the inner end of Yellow Mill channel, and the inner end of Johnsons River, where, on account of ledge rock, the full project dimensions of the channels were not obtained.

The river and harbor act of 1907 authorized the extension of this project to include an anchorage basin 22 feet deep, 1,280,000 square feet in area opposite the inner breakwater; deepening the main entrance channel to 22 feet as far as the inner end of the 22-foot anchorage basin; an additional anchorage basin 12 feet deep, 608,600 square feet in area, northwest of the 22-foot basin; and 2 breakwaters for the protection of the deep-anchorage basin. The breakwaters and the 12-foot anchorage basin have been completed, and the other work is now under way. The Cedar Creek improvement had previously formed a part of a separate project for improvement of Black Rock Harbor under which $72,900 has been expended.

The district officer now submits with favorable recommendation a plan for further improvement, which provides for extending the 18-foot depth up the Poquonock River to a point 1,500 feet below the head of the improved channel, widening the channel, and cutting off certain bends; for deepening to 12 feet Cedar Creek throughout its length up to the head of each branch, with slight widening at some of the bends; and for extending the dredging to the 12-foot contour in Long Island Sound; all at an estimated cost of $90,000, with $6,000 annually for maintenance after completion. He believes that the entire cost should be borne by the General Government.

I concur with the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors that this locality is worthy of improvement as indicated.

The Board of Engineers for Rivers and Harbors is of opinion that the question "whether the whole or any part of the cost of the improvement should be borne by the General Government" is one which should be determined by the general policy Congress may adopt relative to participation by local interests in the cost of harbor improvements, and in this view I concur. Attention is invited to the Board's statement that in similar cases, with few exceptions, the improvement has been made at the expense of the General Government, and to the item in the river and harbor act approved March 3, 1909, which directs that a board of engineers shall be appointed to consider, among other things, the question of "uniform rules in making harbor improvements."

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

Bridgeport Harbor, with its various branches, composes the inner portion of a large bay of Long Island Sound lying between the eastern part of Stratford Point and Fairfield reef. The harbor itself consists of a shallow bay about 1 mile wide at the mouth and 1½ miles long. Black Rock Harbor, which is now considered as a part of Bridgeport Harbor, lies about 2½ miles to the westward of the entrance to Bridgeport Harbor proper. Bridgeport Harbor proper has three branches which have all been improved—Johnsons River, Yellow Mill Pond, and Poquonock River. Black Rock Harbor has two branches which have been improved—Cedar Creek and Burr Creek.

Very little freight is now unloaded in the main harbor except by the railroad company and a few manufacturing concerns and oyster companies that still own docks there. The result of this condition of affairs is that a very large proportion of the ordinary commerce of the port aside from that handled by the railroad company has to be unloaded in the various branches of the harbor. During the calendar year 1908 the total tonnage of Bridgeport Harbor amounted to 890,895 tons. Of this amount, 283,142 tons, or nearly 32 per cent of the entire traffic of the whole harbor, and more in tonnage than was unloaded and loaded in the main harbor, was unloaded in the Poquonock River, and 178,919 tons, or 20 per cent of the total, was unloaded in Cedar Creek. In other words, the two branches of Bridgeport Harbor which are under consideration at the present time handled more than half the total tonnage of Bridgeport Harbor for the year 1908.

WATERWAY TO CONNECT CHESAPEAKE AND DELAWARE BAYS.

The following is from Senate Document No. 215, Fifty-ninth Congress, second session:

BALTIMORE, MD., *January 1, 1907.*

SIR: The commission was authorized by public resolution No. 37 (Appendix A) of the Fifty-ninth Congress to "examine and appraise the value of the works and franchises of the Chesapeake and Delaware Canal, connecting the waters of the Chesa-

peake and Delaware bays, with reference to the desirability of purchasing the said canal by the United States and the construction over the route of the said canal of a free and open waterway having a depth and capacity sufficient to accommodate the largest vessel afloat at mean low water," and also "to the extent that the same can be done from the surveys heretofore made under the direction of the War Department and within the limits of the appropriation herein made" to "examine and investigate the feasibility, for the purpose of such a waterway, of the route known as the Sassafras route." The commission was ordered to "make a report of its work, together with its conclusions upon the probable cost and the commercial advantages and the military and naval uses of each of the said routes, to the Secretary of War, who shall transmit the same to Congress at its next session." In accordance with these instructions the commission has the honor to submit its conclusions, and, following them, its full report:

CONCLUSIONS.

1. *Appraisement of the Chesapeake and Delaware Canal.*—The commission believes that no higher value than $2,514,289.70 should be paid by the Government for the works, franchises, bonds, real property holdings, and all other claims of the Chesapeake and Delaware Canal Company, except certain outside holdings which have been deducted.

2. *The desirability of purchasing said canal and the construction over the route of a free ship canal.*—The commission believes the purchase of the present canal to be desirable and the construction over the route of a free ship canal to be justified by the demands of commerce and by military and naval considerations.

3. *The feasibility of the Sassafras route.*—The commission finds this route entirely feasible, but more costly than the Chesapeake and Delaware Canal or Back Creek route.

4. *The cost of a canal on the Sassafras route.*—The probable cost of a canal on the Sassafras route would be $23,071,864 by the Blackbird or $21,143,470 by the Appoquinimink.

5. *The commercial advantages.*—The commercial advantages would be practically the same by both the Sassafras and the Chesapeake and Delaware routes.

6. *Military and naval uses of each of said routes.*—They would be identical, except that the selection of the Sassafras route would necessitate the removal of the present defenses of the Delaware, entailing an expense of $2,150,000.

7. *The selection of route.*—The commission believes the present Chesapeake and Delaware Canal route to be better, because for a ship canal it would be cheaper; because it offers equal commercial advantages; because, being defended, it has an additional advantage of cost of $2,150,000; because it has fewer bridges; and because it is a developed property possessing earning capacity.

CLATSKANIE RIVER, OREGON.

Report on a recent survey is printed in House Document No. 633, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, January 29, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated June 12, 1909, by Maj. J. F. McIndoe, Corps of Engineers, and October 5, 1909, by Maj. J. B. Cavanaugh, Corps of Engineers, on preliminary examination and survey, called for by the river and harbor act approved March 3, 1909, of Clatskanie River, Oregon.

The original and present project, adopted in 1899 and completed in 1902, provided for dredging out the obstructing shoal and cutting off two sharp bends below the town of Clatskanie. Recent operations have been for maintenance of the improvement.

Below the railroad bridge, and extending a farther distance of about 1 mile, the Columbia Agricultural Company is dredging, at its own expense, a channel 40 feet wide at bottom and 6 feet deep at low water, and the district officer states that no further work on this portion of the stream will be necessary. He also states that to provide a similar channel up to the town of Clatskanie would require the dredging of about 1,900 cubic yards of material at an estimated cost of $4,200, with $1,000 annually for maintenance after completion.

I concur with the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors that this locality is worthy of improvement by the General Government as indicated.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

The town of Clatskanie has a population of from 1,200 to 1,500, and is the center of a thriving and prosperous community. It is the outlet to the Nehalem Valley, and the distributing point for the surrounding settlements which are fast settling up, and, including the town of Clatskanie, embraces a population estimated at 5,000 people. In addition to the above, the town of Clatskanie is the trading point for those engaged in the fishing industry on the Columbia River in the vicinity, and also for several of the settlements bordering on the north bank of the Columbia River.

The commerce consists of the commodities and supplies used by the people—lumber, logs, shingles, and agricultural products. Mr. C. L. Conyers, president of the city council of Clatskanie, states that about 95 per cent of the commerce is carried by water, it being the cheaper and more direct route of transportation, as all freight shipped by rail has to be hauled by teams between the town and depot, a distance of 1 mile, making an additional charge of 50 cents per ton to be added to the railroad rate.

The commerce of the river during the calendar year 1908 amounted to 44,485 tons, valued at $346,547.

COQUILLE RIVER, OREGON.

Report on a recent survey is printed in House Document No. 673, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, February 8, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated June 14, 1909, and January 8, 1910, by Maj. J. F. McIndoe, Corps of Engineers, on preliminary examination and survey, respectively, called for by the river and harbor act of March 3, 1909, of Coquille River, Oregon, from the mouth, including the bar thereof, up to Myrtle Point.

The existing project for the mouth of Coquille River, as adopted in 1878 and afterwards modified, provided for securing a permanent channel over the ocean bar 8 feet deep at mean low tide by the construction of two converging high-tide jetties. This project has been completed. No work of improvement has ever been done by the General Government between Bandon and Coquille, a distance of 25 miles. However, in 1892 a project was adopted covering the section of the river between Coquille and Myrtle Point which, as afterwards modified, provided for the deepening of the channel between these two points to 4 feet at mean low tide for a width of 50 feet by removing snags, dredging shoals, and constructing contraction dikes at the shoals. No work has been done on this part of the river since 1901.

The district officer submits a plan for further improvement, providing for removal of snags from the river between the mouth of the North Fork and Bandon; removal of the mid-channel rock at Rocky Point and the rocks near the mouth of the river; and dredging a low-water channel 100 feet wide through the shoals, 9 feet deep between Coquille and Riverton, and 10 feet deep between Riverton and the mouth of the river. He estimates the cost of this improvement to be $50,000, which includes $27,840 already favorably recommended in a report published in House Document No. 399, Sixtieth Congress, first session. The estimated cost of annual maintenance is $6,000. The district officer also states that improvement of the river between Myrtle Point and the mouth of North Fork, a distance of 1 mile, is impracticable, except at an unwarranted expense, and that further improvement of the bar channel at the mouth is considered unnecessary at this time.

I concur in the opinion of the district officer and the Board of Engineers for Rivers and Harbors that this locality is worthy of improvement by the General Government to the extent proposed.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

The local commerce of the river is carried on by the small steamboats before mentioned, and by scows; and saw logs are rafted.

The Coquille Transportation Company states that 5,190 tons of miscellaneous commerce, of an estimated value of $212,700, were carried on the river between Coquille and Bandon during the fiscal year ending June 30, 1908, and about the same amount for the calendar year ending December 31, 1908.

No reliable statistics of the commerce carried by river between Coquille and Myrtle Point are available, but shippers estimate that the yearly imports and exports to and from Myrtle Point amount to 5,000 tons, part of this being carried by rail and part by boat. In addition, the shipments from Norway and Arago, below Myrtle Point, situated on the opposite side of the river from the railroad, and consequently all by boat, amount to nearly as much more.

It is thought that the above estimate of freight carried yearly on the Coquille River is more apt to be under than over the actual amount, as much goes on gasoline boats and scows, of which no record was kept. Many million feet of saw logs are floated down the river annually.

DELAWARE RIVER FROM PHILADELPHIA TO THE SEA.

Report on a recent survey is printed in House Document No. 733, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, March 2, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated April 14, 1909, and January 22, 1910, with maps, by Maj. Herbert Deakyne, Corps of Engineers, on preliminary examination and survey, respectively, called for by the river and harbor act approved March 3, 1909, of Delaware River from Allegheny avenue, Philadelphia, Pa., to the sea, with a view to obtaining a channel 35 feet in depth and of suitable width.

A project for improvement of this river providing for a channel 600 feet wide and 30 eet deep from Christian street, Philadelphia, to deep water in Delaware Bay has recently been completed, with the exception of the removal of a small amount of rock at Schooner ledge, but work is in progress to maintain the project depth.

The district officer now submits plans for obtaining channels of varying capacity, as follows:

(*a*) Extending the existing project to include the removal of deposits where necessary, with additional width at the turns and in congested localities where anchorage must be had, at an estimated cost of $1,185,000, with $200,000 annually for maintenance.

(*b*) Channel 33 feet deep and 800 feet wide, increasing to widths of 1,200 feet at Bulkhead bar and 1,000 feet at other turns, at an estimated cost of $8,190,000 with $250,000 annually for maintenance.

(*c*) Channel 33 feet deep and 1,000 feet wide, increasing to 1,500 feet at Bulkhead bar and 1,200 feet at other turns, at an estimated cost of $10,530,000, with $300,000 annually for maintenance.

(*d*) Channel 35 feet deep and 800 feet wide, increasing to widths of 1,200 feet at Bulkhead bar and 1,000 feet at other turns, at an estimated cost of $10,920,000, with $300,000 annually for maintenance.

(*e*) Channel 35 feet deep and 1,000 feet wide, increasing to widths of 1,500 feet at Bulkhead bar and 1,200 feet at other turns, at an estimated cost of $13,560,000, with $350,000 annually for maintenance.

These plans all contemplate dredging and rock removal, and in each of the above estimates except (*a*) there is included $1,070,000 for dike work, which the district officer believes will result in greatly reducing the cost of future maintenance. He considers the improvement in accordance with plan (*d*) as worthy of being undertaken by the United States, and the division engineer concurs in this opinion.

These reports have been considered by the Board of Engineers for Rivers and Harbors, which has held a public hearing in Philadelphia, and in its report, dated March 1, 1910, the Board states that the channel dimensions of the present project are insufficient to meet the demands of the growing commerce of Philadelphia and vicinity. Believing that the depth of 35 feet now proposed will be utilized by the time it can be made available and that the commercial and navigation interests involved are sufficient to justify improvement to that depth, the Board recommends the improvement as proposed.

I concur with the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors that Delaware River is worthy of improvement from Allegheny avenue, Philadelphia, to the sea, with a view to securing a channel 35 feet deep and 800 feet wide, increasing to 1,200 feet at Bulkhead bar and 1,000 feet at other turns, at an estimated cost of $10,920,000, with $300,000 annually for maintenance, but am of the opinion that the cast of maintenance both during the execution of the work and after the 35-foot channel is secured has been underestimated; therefore liberal appropriations will be necessary to insure satisfactory progress.

Any project adopted for this improvement should be subject to such minor modifications as may be found desirable in the execution of the work.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

The Board of Engineers for Rivers and Harbors in its report says:

With a view to securing all possible information regarding present and prospective commerce, the size and character of vessels engaged in traffic at this locality, and a full understanding of the needs of the port, the Board held a public hearing in Philadelphia on February 24, 1910, which was attended by a large number of persons representing the varied interests of the city of Philadelphia and adjacent cities and towns. Many commercial and maritime organizations presented written statements covering a large field of inquiry, and much information was thus secured.

Without going into details or figures, the data presented may be summarized as follows:

Philadelphia has a very large, valuable, and rapidly increasing commerce, which can not be successfully handled on the present project depth of 30 feet. Many vessels engaged in business at this port are obliged to load to less than their full capacity, and even under these conditions frequently go aground. Vessels similar to those engaged in business at Boston, Baltimore, Norfolk, and New York (except the largest trans-Atlantic liners) seek trade at Philadelphia, but can not be employed for lack of sufficient channel capacity. Philadelphia should be placed on a parity with the cities just mentioned, and to meet the needs of navigation a channel of ample width and a depth of not less than 35 feet is required.

It seems evident from the information now available that the channel dimensions of the present project are insufficient to meet the demands of the growing commerce of Philadelphia and vicinity. It is believed that the depth of 35 feet now proposed will be utilized by the time it can be made available, and that the commercial and navigation interests involved are sufficient to justify the improvement to that depth.

DELAWARE RIVER, PHILADELPHIA TO TRENTON, PENNSYLVANIA AND NEW JERSEY.

Report on a recent survey is printed in House Document No. 702, Sixty-first Congress, second session.

Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., February 8, 1910.

Respectfully returned to the Chief of Engineers, U. S. Army.

A survey of the Delaware River from Philadelphia to Trenton having been made by the district officer, he submits the following estimates of cost of its improvement:

Channel 200 feet wide and 12 feet deep at mean low water	$360,000
Maintenance of above channel per year	20,000
Channel 250 feet wide and 15 feet deep at mean low water	845,000
Maintenance of above channel per year	30,000
Channel 300 feet wide and 18 feet deep at mean low water	1,770,000
Maintenance of above channel per year	50,000

The commercial conditions at the locality, the character of the navigation, and the benefits to be expected from the improvement are set forth in the district officer's report on the preliminary examination. From the information there given it appears that this portion of Delaware River is used by a number of steamers and by many barges carrying coal and sand. Statistics for 1908 indicate a total movement of about

1,400,000 tons, having a value of over $5,000,000. The steamers referred to draw from 7 to 8 feet when loaded, and experience considerable difficulty in passing the bars in the upper part of the river. While the present depth is sufficient for the barges carrying coal and sand, it is not adequate for tugs of the size required to handle this traffic properly. The district officer believes that an improved channel would exercise a healthful influence upon prospective commerce, and would also afford benefits in the shape of reduced rail rates on traffic not actually following the river route.

For the reasons given above, and others explained by him, the district officer believes this portion of the Delaware River is now worthy of improvement by the United States to the extent of making and maintaining a channel 12 feet deep at mean low water and 200 feet wide from Allegheny avenue, Philadelphia, to Trenton, at an estimated cost of $360,000 and $20,000 per year for maintenance, by which improvement an opportunity will be given for increased use of water transportation and the development of commerce. The Board joins the division engineer in concurring in this opinion, and it recommends adoption of the project specified above.

The district officer describes existing wharves and terminal facilities, and also gives consideration to the question of floods. In compliance with the provisions of section 13 of the act of March 3, 1909, the Board reports that there are no questions of water power or other subjects not considered within which are so related to the project proposed that they may be coordinated therewith to lessen the cost of this improvement and compensate the Government for expenditures made in the interests of navigation.

DE PERE HARBOR, WISCONSIN.

Report on a recent survey is printed in House Document No. 522, Sixty-first Congress, second session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., December 21, 1909.

Respectfully returned to the Chief of Engineers, U. S. Army.

The information contained in the report on preliminary examination, supplemented by that within, indicates that the needs of existing and reasonably prospective commerce at De Pere Harbor will be satisfactorily met by the maintenance of the present project for a channel 17 feet in depth if extended to provide for a suitable turning basin at De Pere.

The estimated cost of such a basin as given within is $11,500. This sum appears reasonable when compared with the probable resulting benefits to commerce, and therefore the Board concurs with the district officer and the division engineer in the opinion that the existing project should be extended to include the turning basin as proposed within.

The district officer submits in a supplementary report a description of existing wharf and terminal facilities. Complying with section 13 of the act of March 3, 1909, the Board reports that there are no questions of water power, terminal facilities, or other subjects so related to the project proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures made in the interests of navigation.

For the Board:

DOUBLE CREEK, NEW JERSEY.

Report on a recent survey is printed in House Document No. 646, Sixty-first Congress, second session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., January 24, 1910.

Respectfully returned to the Chief of Engineers, U. S. Army.

The district officer submits herein an estimate, in the sum of $10,600, for a channel 5 feet deep and 75 feet wide from the bridge at Barnegat to the 5-foot contour in Barnegat Bay. He states that for a channel of this depth a width of 40 feet would be sufficient if increased somewhat at the mouth and at the worst bends, and that such a channel could be provided for $7,800.

As stated in its indorsement on the preliminary examination, the township committee of Union Township proposed to cooperate with the General Government in this work to the extent of assuming the future maintenance of the channel if constructed and to regulate navigation and anchorage, etc., through a harbor master to be appointed by the township. The district officer ascertained that under existing laws the township had no legal authority to assume these responsibilities.

Interested parties were advised of the views of the district officer and were given an opportunity to reply thereto. A delegation from the locality appeared before a committee of the Board at a hearing in Atlantic City on January 13, 1910, and explained that from investigations made it appeared that the views of the district officer were correct, but that upon learning this fact immediate steps were taken to have the necessary laws enacted whereby the locality could legally undertake to maintain the channel if once constructed by the United States. Copies of certain correspondence regarding this phase of the subject were furnished the Board, and it was stated that there appeared to be no obstacle in the way of securing the desired legislation at an early date.

It appears from an analysis of the information now available that this locality does an annual business of about one-half million dollars; that there are boats and other property pertaining to the business done over the waterway valued at about $236,000; that the present water-borne commerce, which is handled with great difficulty and inconvenience, is valued at about $139,000; and that if the waterway were improved business would increase about $300,000 annually. The commerce is generally of a local character, but there is some coastwise business, and those interested assert that this item will be greatly increased in case of improvement.

From all the facts presented it appears that an improvement of this channel would be of material value to this small community, which is to a great extent dependent upon its use. It is believed, however, that the improvement is not of sufficient importance to general commerce and navigation to justify the United States in undertaking both its construction and its future maintenance. If, however, the locality will, under proper legal authority, assume the future maintenance of the waterway, the Board believes that the General Government would be justified in providing the smaller channel referred to above.

In view of the foregoing, the Board recommends the adoption of a project for a channel 5 feet in depth and 40 feet in width from the bridge at Barnegat to the 5-foot contour in Barnegat Bay, at an estimated cost of $7,800; provided, however, that before construction is undertaken the locality shall be required under proper legislative action to provide, in a manner satisfactory to the Secretary of War, for the future maintenance of said channel, and provided further that the necessary right of way for said channel is given without cost to the United States.

In compliance with the provisions of section 13 of the act of March 3, 1909, the Board further reports that neither the establishment of terminal facilities, the development and utilization of water power for industrial and commercial purposes, nor any other subjects not considered within, are so related to the project for improvement of navigation at this locality as to be coordinated in a logical and proper manner with such project to lessen the cost thereof and to compensate the Government for expenditures made in the interest of navigation.

DUNKIRK HARBOR, NEW YORK.

Report on a recent survey is printed in House Document No. 720, Sixty-first Congress, second session. The following report of the Board of Engineers is concurred in by the Chief of Engineers:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., February 15, 1910.

Respectfully returned to the Chief of Engineers, U. S. Army.

In its indorsement of June 29, 1909, reviewing the report of the district officer on preliminary examination of Dunkirk Harbor, the Board described briefly the improvements heretofore made by the General Government at this locality, and expressed the opinion that on account of the absence of any commerce at the port and the evident lack of interest by the community, it was inadvisable for the United States to continue expenditures for its improvement.

Since the report of the Board on preliminary examination, mentioned above, there has been a marked revival of interest in the harbor, and it appears that the community is now disposed to take an active part in furthering its commercial utilization. In order to obtain a more intimate knowledge of conditions, the Board, through a com-

mittee of its members, visited the locality and held a public hearing, and it has also given a hearing at its offices in Washington to Hon. E. B. Vreeland, M. C., and a delegation of interested persons from the locality.

It is the contention of local interests that the lack of commerce in this harbor is due to the unsafe condition of the entrance. It is claimed that the bend in the entrance channel is difficult to navigate in northeast and southwest winds, on account of the existence of a rocky reef on the shore side of the channel, which renders navigation so precarious that vessels of large size refuse to call at the port. In a written statement filed with the Board, it is stated that two vessels have been driven upon this reef. From this document and other information given the Board, it now appears that the locality is desirous of cooperating with the Government to the extent of providing suitable wharf facilities, which have been almost entirely lacking for several years. It is confidently expected by those interested that, with the amelioration of the difficulties at the harbor entrance and the provision of adequate terminal facilities, the commercial development of the harbor will be assured. It is expected that a number of neighboring towns will utilize the harbor as a shipping terminus.

At the request of the Board, approved by higher authority, the district officer has submitted an estimate of cost in the total sum of $99,275, including 10 per cent for contingencies, covering the cost of removing the rocky reef bordering the entrance channel inside the breakwater to a depth of 18 feet over the area cross-hatched in black on the accompanying chart. The fixed structures of the entrance, though badly deteriorated in places, will, nevertheless, perform their functions for a sufficient period of time to give ample opportunity for reasonable development of commerce. In view of the apparent intention of the community to make use of the harbor and to provide terminal facilities therein, and having in mind the large expenditures already made by the United States, the Board believes that it is expedient for the General Government to undertake the additional work now desired at an estimated cost of $99,275. While this work is not all that is desired by local interests, the Board believes that it will very materially improve existing conditions and involves as great an expenditure as is at present justified.

It is recommended, however, that before any expenditures are made by the Government local authorities be required to give assurance satisfactory to the Secretary of War that they will construct a suitable concrete dock, as proposed in the accompanying communication, or provide such other terminal facilities as may be approved by the Secretary of War.

In compliance with the requirements of section 13 of the act of March 3, 1909, the Board reports that, except as covered by the above recommendations, there are no questions of terminal facilities, water power, or other subjects so related to the project proposed that they may be advantageously coordinated therewith in the interests of commerce and navigation.

For the Board:

W. E. CRAIGHILL,
Lieut. Col., Corps of Engineers,
Senior Member Present.

EAST BOOTHBAY HARBOR, MAINE.

The following is from House Document No. 684, Sixty-first Congress, first session, and is supplemental to that printed in House Document No. 944, Sixtieth Congress, first session (summarized in this report, p. 5), and relates to an extension of the project set forth therein.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, February 10, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated April 27 and October 15, 1909, with map, by Lieut. Col. Geo. A. Zinn, Corps of Engineers, on preliminary examination and survey, respectively, and report supplemental thereto dated December 22, 1909, called for by the river and harbor act approved March 3, 1909, of East Boothbay Harbor, Maine, with a view to an extension of the improvement contemplated in the report submitted in House Document No. 944, Sixtieth Congress, first session.

The improvement referred to provides for securing a depth of 8 feet at mean low water by dredging, without the removal of ledge, in front of all the wharves at East Boothbay Harbor except the two northerly ones, and it is estimated to cost $4,000 with $400 annually for maintenance thereafter. The desired extension is for the

purpose of providing the same depth of water in front of these two wharves. The district officer reports that this will require the dredging of an area about 160 feet by 180 feet at an estimated cost of $2,500, omitting the removal of any ledge that may be encountered, and that the maintenance for this part of the improvement will be $100 per annum. The estimate is based upon the prosecution of this work at the same time as the originally recommended improvement.

I concur in the opinion of the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors, that extension as proposed, of the project now before Congress, is worthy of being undertaken by the General Government.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

FALL RIVER HARBOR, MASSACHUSETTS.

Following is the letter of the Chief of Engineers submitting a report of survey printed in House Document No. 778, Sixty-first Congress, second session:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, March 11, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated April 30 and December 29, 1909, with maps, by Lieut. Col. J. C. Sanford, Corps of Engineers, on preliminary examination and survey, respectively, called for by the river and harbor act approved March 3, 1909, of Fall River Harbor, Massachusetts, with a view to providing an anchorage area of a depth of 25 feet, extending from Borden flats light northerly to Slades Ferry Bridge, so called, and westerly to such a point as may be deemed feasible; also with a view to the construction of a breakwater from said Borden flats light to such point as may be deemed necessary; also a supplemental report, dated February 23, 1910, by Colonel Sanford, addressed to the Board of Engineers for Rivers and Harbors.

Under a project completed in 1904 there has been secured a channel 300 feet wide and 25 feet deep at mean low water along the city front between the Old Colony wharf and deep water at the upper end of the city front; also a channel of the same dimensions through Mount Hope Bay to connect the deep water in front of the city with the deep water of Narragansett Bay.

The district officer now submits a plan for further improvement, contemplating deepening to 25 feet the area between line shown on the accompanying map and the existing 25-foot channel, including also the dredging of the eastern side of the channel to the harbor line, involving the removal of 1,939,383 cubic yards of material, all at an estimated cost of $288,000, with $12,000 annually for maintenance. Under certain conditions affecting the establishment of terminal facilities by local authorities, he considers this improvement worthy of being undertaken by the General Government, but he considers the breakwater not necessary at present. In these views the division engineer concurs.

These reports have been considered by the Board of Engineers for Rivers and Harbors, and, believing that an area of less extent than that proposed by the district officer will adequately meet the present and immediately prospective needs of navigation, the Board secured from the district officer a plan contemplating deepening to 25 feet at mean low water the area between the red line shown on the accompanying map and the existing 25-foot channel, including also the dredging of the eastern side of the channel to the harbor line, involving the removal of 961,238 cubic yards of material, at an estimated cost of $143,000, with $6,000 annually for maintenance, and recommends this plan for adoption.

I concur with the Board of Engineers for Rivers and Harbors that this locality is worthy of improvement by the General Government as proposed, at an estimated cost of $143,000, with $6,000 annually for maintenance, and that the construction of a breakwater is not necessary at present.

Attention is invited to the remarks of the Board concerning the recommendations of the district officer in regard to additional wharf facilities which he deems necessary for the full use of the proposed improvement of the harbor.

Very respectfully,

FREDERIC V. ABBOT,
Acting Chief of Engineers.

The SECRETARY OF WAR.

Of the total water commerce of the port in the calendar year 1908, 1,369,158 tons, valued at $68,387,500, the item of coal amounts to 703,486 tons, valued at $3,219,646. This is brought in barges and sailing vessels, the proportion carried by barges being about nine-tenths of the whole. The barges from New York Bay points, which bring most of the anthracite coal, draw from 8 to 10 feet. Those from Chesapeake Bay points and Delaware Bay points draw from 18 to 23 feet. Sailing vessels bringing coal draw from 18 to 23 feet. The freight rates on coal from New York Bay points are from 40 to 50 cents per ton and from Delaware Bay and Chesapeake Bay points from 50 to 70 cents per ton, according to size and draft of vessels, etc. The deep-water anchorage is desired for the coal-carrying barges and schooners, as well as for the lumber-carrying schooners, of which several arrive each year. At the present time these anchor for the most part on the shoal to the eastward of the channel, on which the depth is from 18 to 23 feet, and at low tide they are often aground. Records which have been kindly kept for me by Mr. A. Homer Skinner, of Fall River, Mass., show that the total number of vessels anchored in the harbor above Borden flats light from March 11, 1909, to April 20, 1909, was 257, of which 192, were barges and 65 were sailing vessels, giving an average of about 6¼ vessels of both kinds per day. Mr. Skinner states that this average is somewhat less than that for the year.

The next largest item is general merchandise and machinery. The total amount of general merchandise and machinery imported or exported by water in 1908 was about 578,367 tons, having a value of about $57,806,800. Of this, about 449,019 tons was carried on the Fall River Line of steamers, belonging to the New England Navigation Company, which is the principal marine branch of the New York, New Haven and Hartford Railroad Company; 86,883 tons by the Merchants and Miners Transportation Company (running between Fall River and Philadelphia, Baltimore, and Norfolk); 32,465 tons by the Dyer Transportation Company (running between Providence and Fall River); and about 10,000 tons by the Neptune Line (running between Fall River and New York, but discontinued February 29, 1908). The greater part of this tonnage consisted of through shipments, the freight being transferred at Fall River from boats to rail and vice versa. The rate on first-class freight by boat between Fall River and New York is 27 cents per hundred pounds, the distance being about 183 miles. It was learned that practically all the general merchandise and machinery carried between New York and Fall River and between New York and Boston and other points for which Fall River is the distributing point of a certain district marked out by the railroad company is carried by the Fall River Line boats, the district lying between those of which Providence and New Bedford are the distributing points, these ports also being served by steamboat lines of the New England Navigation Company; and that, in general, only freight from or to points west or south of New York is carried by rail, through the company's Harlem River Terminal. On general merchandise and machinery, as well as on cotton, there is no competition between Fall River and New York by water, or between water and rail. All railroad lines running out of Fall River are owned by the New York, New Haven and Hartford Railroad Company.

About 74,323 tons of coal, building materials, etc., passed through the harbor to or from the Taunton River. This tonnage is included in the Fall River tonnage above.

FRANKFORT HARBOR, MICHIGAN.

In 1867, when the United States began work of improvement at this harbor, which is the entrance to Lake Aux Becs Scies, there existed an outlet about 750 feet north of the present channel, affording a depth of 3 to 4 feet and width of 70 to 80 feet between slab piers, built by local enterprise.

The project, adopted in 1866 and amended in 1868, 1879, and 1892, provided for a new outlet, with channel 12 feet deep and 200 feet wide, protected by piers and revetments. The estimated cost, revised in 1897 in compliance with the river and harbor act of June 3, 1896, to cover the cost of securing a channel 18 feet deep, was $413,659.85; further revised in 1899 to $421,938.35. The changes in the original project have been in effect merely extensions, so that the existing project does not differ in kind from the original one. All expenditures may therefore justly be regarded as pertaining to the present project.

To June 30, 1909, there had been expended the sum of $443,710.61, of which $321,508.20 was for construction and $122,202.41 for maintenance.

The following is a summary of the operations during the fiscal year: The contractors for the extension and repair of the south pier prepared the foundation of the new crib by removing the shattered 40 feet of the old work and preparing the foundation for the additional 60 feet to be covered by the new crib and completed the construction of the new crib. Most of this work was done before the close of the working

season of 1908. In the money accounts of this work it will be assumed that 60 per cent of the total cost of this crib must be assigned to new work and 40 per cent to maintenance.

Under a contract dated March 1, for repairing the south pier between stations 0+89.6 and 1+86.6, operations began May 18, but the only work accomplished to the end of the fiscal year was the removal of the ruined old structure.

Between October 3 and 15 the *Gillespie* deepened the outer approach to 20 feet. On March 12 the available depth outside was found to be 18.5 feet, and between the piers 18.2 feet in a very narrow and irregular channel. The *Gillespie* improved this condition April 28 to May 15, the resulting depth being 19.3 feet. The total quantity dredged at this location by the *Gillespie* during the year was 54,716 cubic yards.

The approved project is about 95 per cent completed.

The total expenditure above mentioned has resulted in the creation and maintenance of a channel 18 feet deep, whose natural depth, or depth to which the channel would probably shoal in a few years without dredging, is 12 feet, the width being 200 feet. It is protected by a north pier and revetment 1,900 feet long and a south pier and revetment 1,938 feet long, of which the outer 400 feet was built by the Toledo and Ann Arbor Railroad Company. Dredging from time to time will be required to maintain the depths needed for navigation. The maximum draft that could be carried June 30, 1909, was 19 feet.

Practically the entire commerce of this harbor is transacted by the car-ferry lines of the Ann Arbor Railroad, which has its northern terminus at this harbor. These car ferries run to Kewaunee and Marinette, Wis., upon the west shore of Lake Michigan, and form a highly important link in the through commerce between the Northwest and the Atlantic seaboard. The importance of maintaining adequate facilities at Frankfort Harbor is manifest. This can be done with certainty only by repeated radical dredging. Pier extension unaccompanied by thorough dredging will not serve.

The water-borne commerce at this port has averaged for the last ten years 741,231 short tons, and in 1908 it amounted to 1,330 entrances and clearances with 563,332 short tons of cargo, valued at $61,419,000 and for the most part general in character.

The available balance at this harbor is nearly $10,000, which is sufficient to pay for dredging by the *Gillespie* until June 30, 1911. For the maintenance of the harbor structures until that time, an appropriation of $6,800 is recommended and $13,200 should be appropriated for the addition of 100 feet to the north pier to complete the project.

The last published map of this harbor is found in the Annual Report of the Chief of Engineers for 1884, page 1973.

July 1, 1908, balance unexpended	$35,696.54
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	6,968.80
July 1, 1909, balance unexpended	28,727.74
July 1, 1909, outstanding liabilities	160.28
July 1, 1909, balance available	28,567.46
July 1, 1909, amount covered by uncompleted contracts	18,844.54
Amount (estimated) required for completion of existing project	13,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	20,000.00

GARY HARBOR, INDIANA.

The following reports of the Board of Engineers are concurred in by the Chief of Engineers and printed in House Document No. 955, Sixtieth Congress, first session.

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., December 30, 1907.

Respectfully returned to the Chief of Engineers, U. S. Army.

From the complete description given by the district officer in the within report, it appears that Gary is a manufacturing town now in process of construction by the Indiana Steel Company, a subsidiary company of the United States Steel Corporation,

this development having for its primary object the establishment of a large steel plant with essential municipal improvements and the construction of facilities for the receipt and shipment of products by both rail and water.

From a study of the projected scheme of development as outlined within, it appears that a small portion only of the work contemplated has as yet been accomplished, and that if the project is carried to completion, it will probably result in the creation of a commerce of great magnitude, perhaps rivaling within a few years that of many of our largest cities, and that the water-borne commerce incident to the steel industry may amount to several million tons annually.

The harbor, which exists by authority of a joint resolution of Congress approved May 16, 1906, consists of two parallel piers 250 feet apart, extending from the shore line into the lake about 2,000 feet to a depth of 25 feet, and inshore about 3,000 feet nearly to the Grand Calumet River. It is stated to be the intention ultimately to carry the waterway farther inland until it connects with the Grand Calumet River, a navigable waterway of the United States. If this is done, and the Calumet improved, a large section of country having valuable sites for manufacturing and other industrial plants will be provided with navigation facilities, and a system of important connecting waterways, consisting of the Calumet River, the Gary Harbor waterway, and the Indiana Harbor waterway, will be created.

At present, however, the waterway consists of a single slip 250 feet wide and about 4,000 feet long, only extensive enough to furnish the wharfage necessary to the steel plant itself, and this waterway, with its docks and wharves, will be under the complete control of the Indiana Steel Company. So far as known, no provision has been made or contemplated for turning this waterway over to the General Government with a view to its improvement and control as a free navigable waterway of the United States. Under these conditions it is obvious that the direct benefits to result from this improvement will be to the steel company. It is equally certain, however, that indirect benefits, incapable of being measured or traced, will be felt by the community at large through the creation and distribution of this great commerce by means of the ordinary channels of trade.

The harbor opens toward the north, and its entrance is exposed to the sweep of waves from northerly, northwesterly, and northeastly winds. In its present condition it does not afford a safe anchorage to vessels in bad weather, nor can it be safely entered at such times. It is apparent, therefore, that a breakwater should be made a part of the plan of improvement of this harbor, for without one its purposes can not be fully realized. The question, therefore, "whether a breakwater is necessary," must be answered in the affirmative. It is pertinent, however, to remark that the necessity for a breakwater was recognized by the engineer department at the time when the project of the Indiana Steel Company for the construction of this harbor was under consideration, and the fact that the action of the company in pushing its permanent structures out to deep water, thereby avoiding the expense of exterior dredging, would greatly increase the cost of the breakwater which would subsequently be necessary, was brought out in correspondence when the resolution authorizing the work was before the proper committee of Congress.

From the information briefly given above, it will be apparent that the determination of the advisability of expending public funds for the construction of a breakwater at this locality involves the consideration of economic conditions of unusual character. Public improvements in aid of commerce are usually of a nature calculated to influence or permit the development of a general traffic, while the present plan for the development of Gary Harbor by corporate interests indicates that the direct benefits derivable from any work of improvement provided by the United States would probably accrue solely to those interests for all time, inasmuch as the absolute control of all abutting lands by that corporation affords them an effective monopoly of the harbor for commercial purposes. Unless, therefore, the scheme of development is modified so as to permit of a more general use of the harbor facilities, the value of the improvement to the public will, as stated above, be confined to indirect benefits of an extent and character not susceptible of determination.

Under these circumstances the Board hesitates to express an opinion as to the propriety of the United States entering upon the construction of this breakwater, believing the question to be one of policy not yet outlined by Congress. This being the case, it remains simply to submit all obtainable information for the consideration of that body. As the cost involved is an important item in determining the advisability of an improvement, the Board believes that this should be included in the information placed before Congress, and therefore recommends that the district officer be directed to prepare an estimate of cost of a suitable breakwater for the protection of this harbor, and that he be authorized to make such survey as is necessary for this purpose.

In connection with this subject Hons. J. A. Hemenway and A. J. Hopkins, United States Senators, and Mr. Haney appeared before the Board on December 16, 1907, and presented both written and oral statements bearing upon the necessity and advisability of the United States undertaking the proposed improvement. The argument presented by Mr. Haney, prepared and signed by Mr. E. J. Buffington, president Indiana Steel Company, is submitted herewith.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

From the report of the district officer on a survey and estimate, it appears that a suitable breakwater for the protection of Gary Harbor will cost $1,140,000 for original construction and $10,000 annually thereafter for maintenance.

GRAYS HARBOR AND BAR ENTRANCE, WASHINGTON.

Following is the report of the Board of Engineers on a reexamination of reports of surveys of this harbor. This report is printed in Rivers and Harbors Committee Document No. 29, Sixty-first Congress, second session:

WAR DEPARTMENT,
THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., March 1, 1910.

SIR: 1. By reference from the Chief of Engineers, U. S. Army, the Board has had under consideration the following resolution of the Committee on Rivers and Harbors of the House of Representatives:

"*Resolved by the Committee on Rivers and Harbors of the House of Representatives*, That the Board of Engineers for Rivers and Harbors, created under section three of the river and harbor act approved June thirteenth, nineteen hundred and two, be requested to reexamine the reports on Grays Harbor and bar entrance," Washington.

2. In order that the Board might have full information on the subject of the above resolution, it requested that the district officer be called upon for a report in reference to existing physical and commercial conditions. Subsequent to the above request there was also referred to the Board a resolution on the same subject by the Committee on Commerce of the Senate, which reads as follows:

"*Resolved by the Commerce Committee of the Senate*, That the Board of Engineers for Rivers and Harbors be, and is hereby, requested to submit a further report upon the necessity for continuing work on the north jetty at Grays Harbor bar entrance, and an estimate therefor."

Inasmuch as both of these resolutions refer to the bar entrance, the Board will submit its views and recommendations in one report.

3. Grays Harbor bar has been under improvement since 1898, when work was started under a project which called for a depth of 24 feet at mean lower low water, to be secured by the construction of a single jetty on the south side 18,200 feet long. This jetty was completed to a length of 13,750 feet in 1902, when work was suspended for lack of funds. At that time there was for a brief period a low-tide channel across the bar with a depth of 22 feet, but the north spit soon began to wear away and the bar channel first widened and then separated into several channels radiating from the harbor throat. Conditions became gradually worse and culminated in 1906, when there was a low-water depth on the bar of only 12 feet.

4. In that year the question of the improvement of this locality was referred to this Board by the Committee on Rivers and Harbors, and after due consideration of the physical and commercial conditions, the Board recommended the construction of a north jetty, at a cost of $600,000, to extend for a distance of about 9,000 feet from the high-water line at Point Brown, with a view to arresting the northward movement of the harbor throat and concentrating the tidal flow sufficiently to maintain the desired depth. It was recognized that the work proposed might not result in creating a depth of 24 feet, but it was recommended with a view to improving conditions to such extent as was warranted by the extent and character of the commerce involved. Pursuant to the recommendation then made, the sum of $600,000 was appropriated by Congress for constructing the proposed north jetty, and this structure has been completed with the exception of the placing of about 75,000 tons of stone.

5. The commerce of the locality has continued to increase, and it is estimated that the tonnage over the bar in 1909 was between 900,000 and 1,000,000 tons and that about 900 vessels crossed the bar in each direction. Nearly all the freight is lumber, outward bound, and it is estimated that there is sufficient standing timber naturally tributary to Grays Harbor to keep the present mills going for fifty years. Depths through the bar channel appear to fluctuate considerably. From the best information obtainable there is at present a depth of 18 to 19 feet at mean lower low water. Having in mind the large and growing commerce of the locality, which is of a character most economically carried in vessels of considerable draft, the Board has reached the conclusion that in view of the favorable influence of the north jetty in increasing the bar depths this jetty should be extended 7,000 feet, which would bring the end of the jetty about opposite the present end of the south jetty. The cost of extending the north jetty a distance of 7,000 feet and building it to a height of mid tide, with a width at the crest of 8 feet, is estimated by the district officer at $1,030,000. The Board recommends adoption of this project at the cost estimated, but invites attention to the narrow top width proposed for the jetty, and the probability of its becoming greater by natural settlement during construction, involving some increased expenditure.

6. In compliance with the provisions of section 13 of the act of March 3, 1909, the Board reports that there are no questions of terminal facilities, water power, or other subjects so related to the project proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures made in the interests of navigation.

For the Board:

Very respectfully,

WM. T. ROSSELL,
Colonel, Corps of Engineers,
Senior Member of the Board.

The CHIEF OF ENGINEERS, U. S. ARMY,
Washington, D. C.

GREENWICH HARBOR, CONNECTICUT.

Report on a recent survey is printed in House Document No. 309, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, November 15, 1909.

SIR: I have the honor to submit herewith, for transmission to Congress, reports of May 28 and August 30, 1909, with map, by Lieut. Col. Harry Taylor, Corps of Engineers, on preliminary examination and estimate of cost, authorized by the river and harbor act of March 3, 1909, of Greenwich Harbor, Connecticut, with a view to widening to 100 feet the existing 9-foot channel and continuing the same to the head of the harbor.

Greenwich Harbor is a shallow bay about 2 miles east from the New York State line, extending about 1 mile northward from Long Island Sound. Under a project completed September 2, 1905, a channel 90 feet wide was dredged from the mouth of the harbor to its head, the channel being 9 feet deep to the steamboat dock (about 3,500 feet) and 6 feet deep the remainder of the distance, the upper end being enlarged to form a turning basin.

The district officer states that the depth above the steamboat dock is inadequate for the present traffic, as many deep-draft vessels go to the head of navigation and most of the traffic of the harbor is actually above the steamboat dock, and recommends widening to 100 feet the outer 9-foot channel, deepening the 6-foot channel to 9 feet and widening it to 100 feet, and deepening the turning basin and extending it 200 feet southward, all at an estimated cost of $8,000. The commerce of the harbor is reported for 1908 as 76,160 net tons, valued at $9,778,000.

I concur with the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors that the locality is worthy of the further improvement proposed.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

HACKENSACK RIVER, NEW JERSEY.

Report on a recent survey is printed in House Document No. 643, Sixty-first Congress, second session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., January 24, 1910.

Respectfully returned to the Chief of Engineers, U. S. Army.

A survey of Hackensack River having been made by the district officer, he submits the following estimates of cost of its improvement:

Channel 16 feet deep and 200 feet wide from Newark Bay to Little Ferry, and 12 feet deep and 150 feet wide from Little Ferry to Anderson Street Bridge, Hackensack	$380,851.90
Channel 12 feet deep and 200 feet wide from Newark Bay to Little Ferry, and 12 feet deep and 150 feet wide from Little Ferry to the New York, Susquehanna and Western Railroad bridge	171,018.10
Annual maintenance	6,000.00

In the opinion of the district officer the river is worthy of improvement by the General Government to the extent of dredging a channel 12 feet deep, in accordance with the second estimate given above. There is no commerce between the New York, Susquehanna and Western Railroad bridge and the Anderson Street Bridge, mentioned in the act ordering this investigation, and throughout this distance of about 1 mile the existing depth appears to be ample for the pleasure boats that use it in the summer season.

Having in mind the present commerce of this river and its probable future development, the Board concurs with the district officer in the opinion that Hackensack River is worthy of improvement, with a view to providing a channel 12 feet deep and 200 feet wide from Newark Bay to Little Ferry, and 12 feet deep and 150 feet wide thence to the New York, Susquehanna and Western Railroad bridge, at an estimated cost of $171,018.10 and $6,000 per annum for maintenance. This improvement will afford a depth of about 17 feet at high water at Hackensack, which is believed to be ample for the general uses of commerce, and the expenditure required is believed to be all that is at present justified.

The district officer when submitting his partly adverse report on the preliminary examination invited interested parties to submit their views to this Board, as a result of which a number of communications have been received and considered.

The district officer has given consideration to the question of terminal facilities, and attention is respectfully invited to his remarks on this subject in the within report. In the opinion of the Board there are no questions of water power or other related subjects which could be advantageously coordinated with the project herein recommended in order to lessen the cost thereof and compensate the Government for expenditures made in the interests of commerce and navigation.

For the Board:

W. E. CRAIGHILL,
Lieut. Col., Corps of Engineers,
Senior Member Present.

No improvement of this river has ever been undertaken by the United States. It is tidal and navigable to New Milford, about 20 miles from the mouth, where navigation is cut off by low dams. Navigation above Hackensack, 15 miles from the mouth, is limited to boats of light draft.

In the report on preliminary examination the engineer in charge says:

The annual amount of commerce given in reports upon the surveys of the Hackensack River, dated June 30, 1889, and December 5, 1890, was 258,140 tons, with an estimated value of $2,521,945. There is apparently a decrease since that time of 151,417 tons and a value of $1,791,567.

In order to obtain a depth of 12 feet at the most practicable location at the mouth of the river it would be necessary to move the draw of the Newark branch of the Central Railroad Company of New Jersey to the west. The relocation of this bridge was referred to in reports of 1889 and 1890, above mentioned, also in a special report dated December 30, 1908, upon certain complaints against this bridge. The old and unused

timber trestle with plate-girder draw of the New York, Lake Erie and Western Railroad (No. 7 on the list of bridges) also obstructs navigation and should be removed. On the whole, the seven bridges lying in the lower 3 miles of the river present a most unpromising feature in connection with the future improvement of navigation.

HILLSBORO BAY, FLORIDA.

Report on a recent survey is printed in House Document No. 634 Sixty-first Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, January 29, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated March 31 and November 22, 1909, with maps, by Capt. Geo. R. Spalding, Corps of Engineers, on preliminary examination and survey, respectively, called for by the river and harbor act approved March 3, 1909, of Hillsboro Bay, Florida, from the 24-foot contour in the bay through the present 20-foot channel to the head of the estuary in the direction of Ybor City, thence from the mouth of said estuary through said bay, as near the eastern shore thereof as practicable, to the western end of Hookers Point, and thence through the channel recently constructed by the Tampa Northern Railway Company to said 20-foot channel.

Under a project completed in 1908 there was obtained a channel 20 feet deep at mean low water and 150 feet wide from the lower bay to the mouth of Hillsboro River, with a turning basin at inner end 450 feet wide and 1,050 feet long.

The district officer submits plans for a channel 200 feet wide and 24 feet deep from Tampa Bay along the line of the present 20-foot channel to the turning basin, thence easterly 300 feet wide and 24 feet deep to the mouth of and up the estuary to Ybor City, and from the mouth of the estuary through the present Tampa Northern channel to the main channel, involving dredging and rock removal, at an estimated cost of $1,750,000, with an annual cost of maintenance of $20,000 for five years after completion; after that it is believed that $10,000 annually will be sufficient for maintenance. He considers the locality worthy of improvement as proposed, and this opinion is concurred in by the division engineer, who believes, however, that a portion of the expense should be borne by local interests.

These reports were referred to the Board of Engineers for Rivers and Harbors for consideration, and in accordance with its recommendation the district officer submitted an estimate for a less extensive plan providing for a channel 24 feet deep and 200 feet wide through the present 20-foot channel to the turning basin, and thence easterly 300 feet wide through the Seaboard Air Line Railway bridge to a suitable turning basin, approximately at the entrance to the estuary, at an estimated cost of $1,054,500, and $10,000 annually after completion for maintenance. The Board considers the locality worthy of improvement to this extent, and recommends the modified plan for adoption.

I concur with the district officer in the opinion that this locality is worthy of improvement in accordance with the larger project at an estimated cost of $1,750,000, and $20,000 annually for five years after completion for maintenance, and after that $10,000 annually for maintenance, for the reason that the lesser project does not provide for sufficient facilities for use by the public upon equal terms.

However, my recommendation of the larger project is conditioned as follows:

That no expenditure be made on that part of the harbor between the new turning basin and Ybor City until the Secretary of War is assured that the local municipality will construct wharves or slips having an available length not less than 1,400 feet, which shall be open for the use of the general public under reasonable regulations and charges, and also that the municipality has obtained such control of the property for at least 700 feet on each side of the proposed Ybor channel throughout its length as will insure its use primarily in the interest of general commerce, on equal terms to all; and that all wharfage charges and regulations shall be reasonable and fully controlled by the municipal authorities and subject to the approval of the Secretary of War.

The work considered of greatest importance and first to be executed is that recommended by the Board, the removal of the southern end of Seddon Island and the extension of the channel toward Sparkman Bay approximately 1,000 feet; next, the channel toward Ybor City; and of least importance, the connecting channel through Sparkman Bay.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

The following are extracts from the report of the officer in charge of the survey:

The commerce of Tampa has received a great impetus since the completion of the 20-foot channel and the improved terminal facilities provided about nine months since.

The following commercial statistics for the period of nine months ending September 30, 1909, were compiled by Mr. W. B. Powell, secretary Board of Trade, Tampa, Fla. They are believed to be carefully compiled from reliable data:

Articles.	Tons.	Value.	Articles.	Tons.	Value.
Automobiles	14	$17,249	Hay	5,130	$94,680
Artificial stone	900	7,200	Ice	7,855	38,275
Bacon, salt	795	195,000	Logs, cedar	2,433	55,020
Bananas	3,301	62,719	Logs, cedar, sawn	170	13,000
Brick	4,000	52,000	Logs, pine	29,500	88,915
Beer	1,500	120,000	Lumber, cypress	600	8,000
Beans, dried	250	21,000	Lumber, yellow pine	29,483	379,871
Broom corn	30	5,000	Meats, smoked and cured	300	60,000
Canned goods	6,100	1,220,000	Merchandise, general	93,714	4,915,887
Cement	13,784	159,674	Nails	3,123	75,360
Cigars	180	1,800,000	Naval stores	4,090	215,130
Coal	65,869	328,699	Oil, machine	183	28,350
Cocoanuts	320	6,100	Oranges	3,098	126,000
Crate materials	4,010	240,600	Other fruits	822	24,000
Cross-ties	18,530	129,710	Office fixtures	18	27,000
Crude petroleum	5,000	25,000	Poultry	3	2,500
Cheese	30	9,800	Pitch, sand, gravel, etc	10,850	22,750
Confectionery	100	15,000	Plaster	800	9,396
Coffee, teas, spices	493	108,800	Phosphate:		
Drugs and supplies	256	149,500	Paving	15,000	45,000
Dry goods, hats, shoes, etc	1,277	737,000	Pebble, and rock	20,485	122,910
Dressed meats	800	320,000	Printers' supplies, etc	1,422	40,330
Dried fruits	10	2,000	Rice	755	70,300
Eggs	25	7,250	Salt	3,525	28,732
Electrical supplies	160	60,000	Sand for artificial stone, oyster shells	23,000	19,700
Fertilizers	36,500	1,168,000	Shingles	2,012	60,250
Fish	4,715	269,750	Steel rails	22,200	510,600
Flour	7,939	459,003	Sugar	9,754	514,365
Fuller's earth	11,000	216,000	Tobacco:		
Furniture	323	61,000	Plug	10	8,000
Fruits and produce	150	5,000	Bales	145	481,495
Nuts, etc	47	7,060	Vegetables	2,253	59,690
Fruits, tropical	218	43,600	Waters, distilled and mineral	71	5,150
Gasoline and light oils	4,853	154,650	Window glass	60	4,200
Gas engines	10	2,000	Wines and liquors	318	297,200
Grain	37,764	1,258,124	Wood, fuel	6,030	24,120
Hardware, miscellaneous	10,192	1,013,740			
Hides and skins	62	3,750			
Household goods, private shipments	100	10,000		540,819	18,946,754

The tonnage for 1908 (twelve months) was 560,170 tons, valued at $16,146,696. Taking three-quarters of these figures for purpose of comparison with the statistics herein given, it is found that the commerce has increased 29 per cent. It will also be noted that the value has increased over 56 per cent, which is significant and gratifying as indicating the relatively higher grade of traffic now coming to this port.

Mr. Fineren was enabled to apportion the traffic over the different terminals as follows:

	Tons.
Mallory Steamship Company	60,144
Penn Steamship Company	24,885
Lumber companies	6,600
Southern Steamship Company, 2 trips only	2,001
Tampa Coal Company	11,640
United States Quartermaster boats	383
Total over the new Hendry & Knight terminals—local merchandise, lumber, etc	105,653
Seaboard terminals: Phosphate, lumber, and coal	37,428
Tampa Northern terminals: Lumber and coal	47,142
Other terminals	350,596
Total tonnage for nine months	540,819

The need of an increased depth of water is keenly felt at this port. The depth now available is insufficient to accommodate most of the vessels loading with phosphate, lumber, and naval stores. These vessels have to complete their cargoes by lightering to the lower bay or by proceeding to other ports where a greater depth of water exists. Incoming vessels, loaded with coal, for instance, bring incomplete cargoes, but charge freight for a full load.

In addition to large quantities of phosphate, which may reasonably be expected to be transported through this port, shipments of lumber and naval stores will constitute very considerable items in the commerce of the locality. In order that such shipments may be handled with facility, wharves of great extent and large area, readily accessible to transportation lines and the business center of the city, are essential. In order to provide such facilities, the extension of the harbor into the Ybor estuary is absolutely necessary.

HUMBOLDT BAY, CALIFORNIA.

Report on a recent survey of Humboldt Bay, is printed in House Document No. 326, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, November 16, 1909.

SIR: I have the honor to submit herewith, for transmission to Congress, reports of May 13 and July 30, 1909, by Lieut. Col. John Biddle, Corps of Engineers, on preliminary examination with estimate of cost of improvement of Humboldt Bay, California, with a view to securing increased depth between Eureka and Arcata, as authorized by the river and harbor act of March 3, 1909.

In October, 1908, a project providing for a channel 18 feet in depth in front of Eureka was completed. The cost of obtaining a channel of the same depth through the shoal just below Indian Island and 16 feet deep through the shoal about 3,000 feet outside the Arcata wharf is estimated at $56,000, with a certain amount for maintenance after completion. The district officer states that the channel dredged in 1882 and 1883 to Arcata to the depth of 10 feet has, contrary to expectations at that time, remained, due to the constant stirring of the water by propellers, and that while doubtless some shoaling will take place in the channel proposed the material deposited will be soft and easy to plow through.

Local interests desire a more comprehensive improvement, involving an extension of the channel toward the main shore at the city of Arcata, the dredging of a turning basin, and the filling of certain areas behind bulkheads to be used for docks, warehouses, etc.

I concur with the district officer, who is also division engineer, and the Board of Engineers for Rivers and Harbors that the locality is worthy of improvement by dredging through the shoals referred to but is not worthy of improvement by the General Government so far as the proposed ship channel to the shore is concerned.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

The main commerce of Humboldt Bay is redwood lumber. Vessels, both sailing and steam, come from all parts of the world. They draw from 18 to 21 feet. It is necessary to cross the entrance bar at or near high tide. It is also necessary to bring vessels over these shoals at high tide. This necessitates great delay and expense. Moreover, at the Arcata wharf, about half the lumber has to be lightered to vessels, further increasing the cost. Vessels frequently ground.

The shipments from the Arcata wharfs which pass over both shoals are—

Article.	Feet.	Tons.	Value.
Lumber	58,000,000	100,000	$1,100,000
General merchandise		2,000	200,000

Those passing over the lower shoal only are—

Article.	Feet.	Tons.	Value.
Lumber	91,000,000	146,500	$1,750,000
General merchandise		3,250	318,000

These shipments are increasing.

HUDSON RIVER, NEW YORK.

Report on a recent examination is printed in House Document No. 719, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, February 24, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports with maps, by Col. W. M. Black, Corps of Engineers, on preliminary examinations of Hudson River, New York, called for by items in the river and harbor act approved March 3, 1909, as follows:

"[May 5, 1909.] With a view to providing a channel not less than 200 feet wide and 12 feet deep at all stages from deep water in the lower river to Waterford, including a lock and dam at Troy suitable in size for all probable purposes of navigation and commerce to and from the barge canal.

"[July 31, 1909.] At Troy, with a view to widening the channel below Adams street.

"[August 2, 1909.] At Albany, with a view to providing additional area of navigable depth at the mouth of Island Creek and vicinity, for the benefit of general commerce and the making up of barge tows.

"[August 2, 1909.] At Coeymans, with a view to securing a suitable width and depth in the channel along the village front behind the government dike."

Also a preliminary report dated January 10, 1910, by Colonel Black, on survey of the river at these localities.

The existing project for improvement of Hudson River provides for a channel 12 feet deep and 150 feet wide from the State dam to the foot of Jacob street, Troy; thence gradually increasing in width to 400 feet at the foot of Broadway, Troy; thence 400 feet wide to Coxsackie.

The district officer presents in his preliminary report on survey a plan for further improvement, the object being to afford suitable navigation facilities for the commerce of the Hudson River and that which is anticipated from the completion of the New York State canals. If this part of the river over which the commerce of the canal must pass is to be improved to meet the development of the state waterways and finished in time for the opening of the Champlain Canal, work must be begun as soon as practicable, as three working seasons will be required to complete a new lock and dam with channels of approach. The district officer has therefore submitted this report in advance of complete detailed studies and estimates, but he states that while the estimates are approximate he believes they are sufficient to cover the work proposed, and that the further study which will be necessary before the work is undertaken will not seriously affect the general plans or estimates.

The plan submitted contemplates the construction of a new lock and dam in the vicinity of Troy about 1,400 feet north of the existing State lock and dam, which will be removed, and the excavation of a channel from deep water in the lower river to Waterford 12 feet deep at all stages. Below Troy the general width of the channel is to be 400 feet, except at Albany, where it widens into a basin. In the vicinity of Troy the width above the dam is to be 200 feet, widening into a basin just below the dam. For a short distance below this basin there will be a double channel, one on either side of Adams Island, with widths, respectively, of 150 and 200 feet. Between the Delaware and the Hudson and Congress street bridges the width is to to be 500 feet, below which it narrows to the proposed general width of 400 feet.

This work will extend nearly as far south as Hudson, and includes dredging, rock excavation, construction of a lock, dam, and mooring piers, and removal of the old lock and dam, all at an estimated cost of $5,186,064. The district officer considers

the improvement worthy of being undertaken by the United States, and states that if the project is approved and work authorized provision should be made for executing it under the continuing-contract system, the amount required for the lock and dam to be provided by a cash appropriation of $300,000, and the balance to be made available within two years in order to insure completion within three working seasons. An initial appropriation of $1,000,000 is required for the work below the dam.

These reports have been considered by the Board of Engineers for Rivers and Harbors, and in its opinion it is advisable for the General Government to undertake the improvement of the Hudson River from deep water up to Waterford, provided all existing water-power rights or privileges affected by the improvement are extinguished by the State of New York, it being understood, however, that both plans and estimates are general in character and require further careful study, particularly with reference to the low-water plane and its bearing upon the elevation of the lower sill of the lock. The Board further states that the cost of maintenance of this improvement will probably not be excessive.

If it be the policy of Congress to make the connection of the navigable channel of the Hudson River with the State canal, by extending the former channel through and above the State dam at Troy, and by the construction of a new lock and dam, I agree with the district officer, who is also division engineer, and with the Board of Engineers for Rivers and Harbors that Hudson River is worthy of improvement in this connection at the cost specified.

In the opinion of the district officer, and the Board, the harbor at Coeymans is not worthy of improvement by the United States, and I concur in this opinion.

The district officer states that it is probable that there will be surplus water sufficient to develop at least about 1,400 horsepower at the new dam, a small portion of which can be used for operating and lighting the lock, and the remainder can be sold. He recommends that if the improvement be adopted the Secretary of War be authorized to grant leases or licenses; (*a*) for the use of the surplus water for water power created by the dam at such a rate and on such conditions and for such periods of time as may seem to be just, equitable, and expedient, the said leases or licenses to be limited to the use of the surplus water not required for navigation and to a period not exceeding twenty years; (*b*) for the occupation of such land belonging to the United States on the Hudson River as may be required for power flumes or other industrial purposes not inconsistent with the requirements of navigation; (*c*) and for the construction of such work or works appurtenant to the dam as may be necessary for the development and use of said water power.

The district officer has been informed by the canal board that it is ready to abandon the present lock and dam as soon as new structures are constructed by the United States, and that the project submitted meets with the approval of the Advisory Board of Canal Engineers.

The matter of cooperation by the local interests in meeting the expense of the proposed improvement has been given consideration by the district officer and the amounts deemed equitable to be required are for Troy and Albany, $420,559 and $105,000, respectively, to cover the cost of additional harbor facilities provided for at these localities in the above estimate.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

LEIPSIC RIVER, DELAWARE.

Report on a recent survey is printed in House Document No. 574; Sixty-first Congress, second session. Following is the report of the Board, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., December 21, 1909.

Respectfully returned to the Chief of Engineers, U. S. Army.

In the within report on a survey of Leipsic River, the district officer submits a project, at a total estimated cost of $94,500, providing for a 7-foot low water depth from Delaware Bay to the vicinity of Garrison's mill, at the head of tide, with widths of 100 feet across the bar and 80, 60, and 40 feet in designated reaches above, including 5 cut-offs and a turning basin. After consideration of the present and prospective commerce involved, he reaches the conclusion that the expenditure required to carry out this improvement in its entirety is not at present warranted.

He believes, however, that the full improvement as planned will not be necessary to permit the expected commercial development. He recommends that cut-offs Nos. 2, 3, and 4 be undertaken at once to avoid the worst bends and longest detours, leaving the question of completing the project to be determined by the subsequent development of commerce. For reasons stated, he proposes a depth of 6 feet and a width of 50 feet for these cut-offs, and with these dimensions estimates their cost at $18,500. This improvement meets the approval of the division engineer, under certain conditions calculated to safeguard the interests of the United States.

As stated in the Board's indorsement on the report of preliminary examination, the territory commercially tributary to this stream is fertile and produces much perishable produce, for which quick and reliable transportation is desirable. The work proposed by the district officer, at a cost of $18,500, will aid in the accomplishment of this result to the full extent now justifiable at the expense of the General Government, and, under the condition that the necessary rights of way be donated free of cost and the United States released from all claims for damages to lands cut off by the proposed channels, the Board believes that it is advisable for the General Government to undertake the improvement.

The question of terminal facilities has been investigated by the district officer, and he has received numerous evidences that the owners of land bordering on the stream contemplate the establishment of all the wharves that would be necessary for the transfer of the commerce to vessels. All available water power in the upper reaches of the river has been developed and appropriated by private enterprise. It is not feasible to create any on the stretch of river susceptible of improvement for navigation. Complying with the provisions of section 13 of the act of March 3, 1909, the Board expresses the opinion that there are no questions of terminal facilities, water power, or other related subjects which can be advantageously coordinated with the project herein recommended.

The following is an extract from a report of the local officer on preliminary examination:

Leipsic River is a tidal stream, tributary to Delaware Bay, lying wholly within Kent County, Del. It enters the bay 10½ miles below Bombay Hook light at the mouth of Smyrna River and 12½ miles above or north of the mouth of St. Jones River. The mouth of the river is abreast of the head of the Blake channel and distant about 2 miles therefrom. The shoal water between these has, to within a quarter of a mile from the shore, a minimum depth of 8 feet. Six feet draft can be carried into the river across the narrow bar just outside of the mouth. The broad, flat foreshore of the bay, with less than 6 feet of water upon it, so troublesome in the improvement of the rivers both above and below Leipsic River, narrows in front of it to a width less than a quarter of a mile. The entrance channel is, however, very narrow, and is bordered on the lower side by a very hard compact mass of gravel, clay, and oyster shells, about 500 feet long (locally known as the "rocks"), which makes entering and leaving the river very hazardous except when the tide is well up.

From the mouth to Leipsic, about 12 miles, the stream is very crooked, although three cut-offs, made many years ago by a private navigation company, have shortened it considerably. At two other points local parties particularly desire cut-offs. There are also some other bends where cut-offs would be to the advantage of both navigation and maintenance of an improved channel.

There are two canning establishments at Leipsic with a combined output of from 75,000 to 100,000 cases a season, according to the crop, and there is a creamery doing a thriving business. Two general stores supply the surrounding country, but aside from these industries and a few stores at Cheswold the locality is devoted to farming interests, and the improvement of the river is desired for the purpose of moving expeditiously the grain, perishable farm products, etc.

During the season of 1908, 3 steamboats of 100 to 150 tons each were kept busy carrying tomatoes from Leipsic to Baltimore. One steamer of 120 tons trades regularly, though not upon schedule, between Leipsic and Delaware Bay and river ports; 11 schooners, from 30 to 100 tons, and 6 power boats trade in the river. In addition quite a fleet of oyster boats, which work the near-by beds of Delaware Bay, make the river their home port. From the answers to inquiries sent out, the following commercial statistics of the river traffic now existing have been compiled:

2,900 tons of salt hay, at $6.50	$18,850
500 tons of phosphate, at $20	10,000
250 tons of soft coal, at $4.50	1,125
150 tons of hard coal, at $7	1,050
60,000 bushels of wheat, at 90 cents	54,000

75,000 bushels of corn, at 70 cents	$52,500
50,000 baskets of tomatoes, at 20 cents	10,000
12,000 cases of tomatoes, at $1.80	21,600
3,000 cases of pears, at $1.50	4,500
Miscellaneous merchandise	41,600
Oysters	10,000
	225,225
Estimated for Whitehall Landing	25,000
	250,225

It is estimated that there is $125,000 worth of business at Cheswold which would immediately seek the river as an outlet if it was improved.

LITTLE CONTENTNIA RIVER, NORTH CAROLINA.

Report on a recent survey is printed in House Document No. 208, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 2, 1909.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated April 27 and October 16, 1909, by Capt. Earl I. Brown, Corps of Engineers, of preliminary examination, with plan and estimate of cost of improvement, of Little Contentnia River, North Carolina, up to the town of Ridge Spring, authorized by the river and harbor act of March 3, 1909.

The district officer presents a plan for improvement of the present channel by removing fallen trees, logs, and snags, and cutting down and hauling back the leaning trees on the banks at an estimated cost of $1,000, and $200 annually for maintenance. He considers the improvement to this extent worthy of being undertaken by the General Government, and this opinion is concurred in by the division engineer, Col. Dan C. Kingman, Corps of Engineers.

These reports have been reviewed by the Board of Engineers for Rivers and Harbors as required by law; but for reasons stated in its report, the Board is of the opinion that the proposed improvement is not of sufficient importance to warrant its being undertaken as a separate work, nor to justify an original expenditure of $1,000. It considers, however, that small expenditures from time to time, in connection with snagging operations on Contentnia Creek, into which the Little Contentnia empties, would be justified, and recommends that the Chief of Engineers be authorized, in his discretion, to expend from appropriations made for improving Contentnia Creek such amounts as in his opinion may be necessary and advisable for snagging on the Little Contentnia. I concur in the recommendation of the Board.

There are no questions of terminal facilities, development of water power, or other similar subjects which should receive consideration in connection with this project.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

LIVINGSTONE CHANNEL, DETROIT RIVER, MICHIGAN.

Report on a recent examination is printed in House Document No. 676, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, February 9, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports made by a special board of engineers, constituted by Special Orders, No. 9, Office Chief of Engineers, March 6, 1909, submitted October 28, 1909, on preliminary examination, and January 19, 1910, with plan and estimate of cost of improvement in

accordance with the following item in the river and harbor act approved March 3, 1909:

"Livingstone channel, Detroit River, with a view to widening the same to 600 feet; and a board of engineers shall be appointed to report upon the probable effect of such widening upon the depth of water in Lake St. Clair and above the point of such proposed widening."

So much of the existing project for Detroit River as relates to Livingstone channel was adopted in 1907, and contemplates dredging a channel west of Bois Blanc Island across Limekiln ridge 300 feet wide and 22 feet deep to Bar Point, and thence 800 feet wide and 22 feet deep to Lake Erie. When completed, it is to be used by downbound vessels only. In connection with the prosecution of work under this project there has been built a cofferdam about 5,800 feet long in the vicinity of Bois Blanc Island.

The special board concludes that the widening of Livingstone channel to 600 feet is not necessary, but recommends that the portion of the channel within the cofferdam be widened to 450 feet and that a dike be constructed from the lower end of the cofferdam to Bois Blanc Island to avoid injurious cross currents, all at an estimated cost of $630,000 and an annual maintenance of $500. This estimate is based on the assumption that the construction of the dam will be authorized before the completion of existing contracts for wet excavation below the cofferdam. The board states that the widening recommended will not injuriously affect the depth of water in Lake St. Clair and above the point of the widening, and calls attention to the fact that the cross dike referred to will be in Canadian waters.

The conclusions and recommendations of the special board are concurred in by the Board of Engineers for Rivers and Harbors and by me.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

LOS ANGELES (WILMINGTON) HARBOR, CALIFORNIA.

Report on a recent survey is printed in House Document No. 768, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, March 9, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated May 21, 1909, by Capt. Amos A. Fries, Corps of Engineers, and January 10, 1910 (with map), by Lieut. Chas. T. Leeds, Corps of Engineers, on preliminary examination and survey, respectively, called for by the river and harbor act approved March 3, 1909, of Wilmington Harbor, California, with a view to obtaining a channel 200 feet wide and 20 feet deep, beginning at the turning basin in said harbor, thence in a northeasterly direction to the east line of the east basin; and also a similar channel beginning at said turning basin, thence in a northwesterly direction to the north line of the west basin.

Wilmington has recently been consolidated with San Pedro and Los Angeles, and the locality is now known as Los Angeles Harbor.

Improvement has heretofore been in progress at the locality under projects as follows:

(*a*) Wilmington Harbor (inner harbor) providing for a channel 400 feet wide, 20 feet deep, from the outer harbor to the foot of the wharves, thence 24 feet deep between harbor lines to and including a turning basin 1,600 feet in diameter just below Mormon Island, repairs to the east jetty, and construction of a dike to divert the waters of the Los Angeles River from Wilmington Lagoon. Changed conditions have rendered the building of the dike inadvisable, and the other work under this project is about completed.

(*b*) Deep-water harbor at San Pedro Bay (outer harbor), providing for the formation of a harbor by the construction of a breakwater 9,250 feet long, about 8,500 feet of which has been completed.

The river and harbor act approved March 2, 1907, provided for an examination of Wilmington Harbor with a view to obtaining an increased depth, report thereon being printed in House Document No. 1114, Sixtieth Congress, second session. The plan of improvement therein presented contemplates dredging to a depth of 30 feet within the limits of the existing project, using the present dredge for the purpose.

The district officer presents a project for further improvement, which contemplates additional channels, each 200 feet wide and 20 feet deep, extending from the turning basin at the upper limit of the present project, one westward and northward to the north line of the west basin and the other northeastward to the east line of the east basin, at an estimated cost of $330,000 if done by contract or $390,000 if done by government plant, the latter amount including $170,000 for construction of a dredge.

Provision is made in the pending river and harbor bill for prosecuting the 30-foot project above mentioned, and if adopted there will be no government plant available for dredging the 20-foot channels until the completion of the 30-foot channel, a period of about three years. Therefore, if the dredging of these 20-foot channels is to be undertaken sooner than three years from the commencement of the 30-foot project, the work will either have to be done by contract or a new government dredge will have to be constructed.

The division engineer favors the construction of a 20-foot channel in the east basin, and also believes it advisable to provide a short channel 30 feet deep to the west of Mormon Island, but he does not recommend a 20-foot channel in the west basin, believing that any improvement in that basin should be to a depth of 30 feet.

These reports have been considered by the Board of Engineers for Rivers and Harbors, and in report dated February 28, 1910, herewith, the Board states that reasonably prospective benefits are sufficient to justify the General Government in undertaking this work, and recommends the adoption of the project outlined by the district officer at an estimated cost of $390,000. The Board states that if a depth of 20 feet is provided and experience demonstrates a necessity for a greater depth, this can be given in the future with little or no loss from the work already done.

I concur in the views and recommendation of the Board of Engineers for Rivers and Harbors.

Very respectfully,

FREDERIC V. ABBOT,
Acting Chief of Engineers.

The SECRETARY OF WAR.

The commerce of Wilmington (now Los Angeles) Harbor has been increasing in extent and value for a number of years, and it appears that local authorities are to expend large sums in the near future in a comprehensive development of wharves and terminals, looking toward a further increase in traffic and a general expansion of business at this locality. There has been a rapid development at Los Angeles and vicinity in recent years, and the steps being taken by that city and by private parties for the betterment and extension of harbor facilities will probably assure a decided increase of commerce in the future.

	Tons.
Foreign commerce	15,596
Domestic commerce	1,122,777
Total	1,138,373

MANISTEE HARBOR, MICHIGAN.

Following is the letter of the Chief of Engineers submitting report on a recent survey printed in House Document No. 705, Sixty-first Congress, second session:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, February 18, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated August 25, 1909, and January 7, 1910, by Maj. Charles Keller, Corps of Engineers, on preliminary examination and survey, respectively, called for by the river and harbor act approved March 3, 1909, of Manistee Harbor, Michigan.

Manistee Harbor is being improved by the United States under a project adopted in 1867 which, as modified in 1892, provides for a channel of navigable width with a depth of 15 feet, extending from Lake Michigan to Manistee Lake, protected by piers and revetments at the entrance The river and harbor act approved March 2, 1907, adopted a project for obtaining a uniform depth of 18 feet by dredging to a depth of 20 feet below zero of the gauge, pier extension, revetment, and protection works. The adopted plan required that satisfactory pledges be given that certain private and municipal work would be completed within a reasonable time, that land for the improvement would be donated, and that the United States would be protected from all claims for damages arising from execution of the project. These

requirements have not been met and no expenditure has yet been incurred on account of this modified project.

The district officer is of opinion that the modified project when completed will not furnish adequate facilities for commerce at this harbor, and presents a plan for securing an entrance 300 feet wide, with a channel 20 feet deep below zero of the gauge at the entrance and between the piers, and 18 feet below zero and 90 to 126 feet wide from the inner ends of the revetments to Manistee Lake. This plan involves extension of the north pier, removal of the existing south pier, construction of a new south pier, and dredging the area between the north pier and the proposed new south pier, all at an estimated cost of $702,000, the work to be provided for under a continuing contract with an initial appropriation of $300,000. The district officer recommends this project on condition that the city of Manistee or other agency donates to the United States all land required in connection with the change in location of the south pier and assumes the duty of improving and maintaining a channel 18 feet deep below gauge zero (16 feet at low water) from Manistee Lake to the inner end of the existing north revetment.

The division engineer, Col. W. L. Fisk, Corps of Engineers, is of opinion that resulting benefits to commerce would be incommensurate with the cost of this project, and recommends only the dredging of a channel 18 feet in depth at low water between the present piers and 16 feet in depth through the river to Manistee Lake.

The Board of Engineers for Rivers and Harbors has considered these reports as required by law, and, concurring in the views of the division engineer, recommends the lesser project outlined above at an estimated first cost of $25,000, and such amounts for annual maintenance as experience proves necessary.

It is my opinion that the project recommended by the Board includes all work that should be undertaken at this time by the Government, but that greater facilities will probably have to be provided at some time in the future under proper conditions as to cooperation by the local interests.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

The water-borne traffic at this harbor has varied in the last ten years from 356,864 tons to 812,259 tons, the mean for the ten years being 526,956 tons.

MINISCEONGO RIVER, NEW YORK.

Following are extracts from House Document No. 79, Sixtieth Congress, first session.

UNITED STATES ENGINEER OFFICE,
New York City, April 26, 1907.

GENERAL: I have the honor to submit the following report of a preliminary examination of Minisceongo River, New York, provided for in the river and harbor act of March 2, 1907, this duty having been assigned me by department letter of March 14, 1907.

The river and harbor act of 1882 provided for the survey of this stream "at its outlet into the Hudson River," and under date of November 28, 1883, Col. John Newton, Corps of Engineers, submitted plans and estimates for securing 10 feet depth down to Grassy Point, by dredging and a system of dikes. Nothing was suggested about securing deeper water in the river itself.

Under date of October 23, 1902, Col. S. M. Mansfield, Corps of Engineers, submitted a report of a preliminary examination of this stream, stating that in his opinion it was worthy of improvement, and recommending a survey with a view to estimating the cost of a channel 8 feet deep and from 80 to 100 feet wide. This recommendation having been approved in the regular way, a survey was made under the direction of Col. Amos Stickney, Corps of Engineers, whose report is dated December 5, 1903, and contains estimates of cost of improvement based on a channel 9 feet deep at mean low water and 80 feet wide. This report was approved by the Board of Engineers for Rivers and Harbors, the Chief of Engineers, and the Secretary of War, and with the map of survey contains all the information needed to make an estimate of cost for a 7-foot channel 80 feet wide.[a]

The Minisceongo is a small tidal river emptying into the Hudson River at Stony Point, about 33 miles above New York City. It is a very crooked stream, having a

[a] These reports are printed in H. Doc. No. 300, 58th Cong., 2d sess.; and at p. 1069 of the Annual Report of the Chief of Engineers for 1904.

depth for much of its length of 7 feet at mean low water, with reaches of deeper water and a bar near its mouth with less than 5 feet.

The part that may be considered navigable extends from the mouth to a point about 1.5 miles above. It is crossed near the mouth by a bridge, which has two draw openings. Just below the bridge a pipe line, belonging to the Haverstraw Water Company, is laid, having over it only 6 feet of water.

About 1 mile above the mouth there is a very sharp bend with so short a radius that it is not practicable, in my opinion, to excavate a suitable channel following the course of the stream.

In my opinion, the stream is worthy of improvement to the extent of providing a channel 80 feet wide and 7 feet deep at mean low water. This width is about as great as the width of the stream will admit of, and the depth as much as can be carried out to deep water in the Hudson.

The brick barges are from 110 to 130 feet long, from 28 to 36 feet wide, and draw from 5½ to 10 feet, or as much as the depth of water will admit of up to 10 feet.

I, however, recommend the improvement only on condition that it is made with the cut-off at the bend, 1 mile from the mouth, and that the right of way be secured without cost to the United States. The water pipe that crosses the stream below the bridge and near the mouth of the river, and over which there is now 6 feet at mean low water, should be lowered 4 feet, so that the bottom can be dredged to a depth of 7 feet, mean low water, without disturbing it.

The commerce reported in 1892 was as follows:

Brick		80,000,000
Sand	cubic yards..	12,000
Wood	cords..	10,000
Coal	tons..	2,000
Coal dust	do....	5,000

The total commerce as reported at present amounts to between 170,000 and 175,000 tons, nearly all of which consists of brick.

* * * * * * *

Very respectfully, your obedient servant,

D. W. LOCKWOOD,
Colonel, Corps of Engineers.

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., May 27, 1907.

Respectfully returned to the Chief of Engineers, United States Army.

The district officer submits an estimate for the improvement of Minisceongo River, in the sum of $22,632, to provide a channel 7 feet in depth at mean low tide and 80 feet bottom width, extending for a distance of about 1½ miles above the mouth.

The plan provides for a cut-off about 1 mile above the mouth, the right of way to be secured to the United States free of charge, and a pipe line crossing the river near its mouth, with only 6 feet of water over it, to be lowered to a depth of 10 feet, also without expense to the United States. No estimate is submitted for maintenance, but it is believed this item will be small.

Having compared the extent and value of the commerce involved with the cost of the work, the Board expresses the opinion, concurring with the views of the district officer, that the improvement is one worthy of being undertaken by the General Government and in accordance with the plans and conditions proposed.

MISSISSIPPI RIVER, BRAINERD AND GRAND RAPIDS, MINN.

Following is the letter of the Chief of Engineers submitting report on a recent survey printed in House Document No. 607, Sixty-first Congress, second session:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, January 28, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated September 1 and December 18, 1909, by Maj. Francis R. Shunk, Corps of Engineers, on preliminary examination and survey, respectively, of Mississippi River between Brainerd and Grand Rapids, Minn., called for by the river and harbor act approved March 3, 1909.

This stretch has a channel length of 181½ miles and an average width of about 250 feet, and its improvement by snagging and removing bowlders, etc., was incorporated in the project for reservoirs at headwaters of the Mississippi River by the act of June 13, 1902. No estimate of cost has been adopted and no work done since November, 1906.

The district officer submits a plan for securing a fairly uniform channel 3½ feet deep at mean low water in this portion of the river, involving a small amount, respectively, of dredging, wing-dam construction, and the removal of snags, trees, etc., the cost of the work being estimated at $22,555.

I concur with the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors that this locality is worthy of further improvement in the manner indicated.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

Following are extracts from the report of the examination:

Commerce.—Present commerce between Aitkin and Grand Rapids is local, and is carried mainly by the steamer *Oriole*, length 107 feet, width over all 22½ feet, carrying capacity 60 tons. This boat serves about 75 settlers, taking their products to market and returning with supplies. During the season of 1908 there was carried about 1,700 passengers and, roughly, 1,500 tons of merchandise, valued at $100,000. The products of this section are mainly agricultural, but there seems to be a future possibility in the extensive growth of hardwood other than for cord wood. The steam barge *Atlas* is somewhat of a tramp, carrying capacity about 100 tons. She is at present engaged in carrying hardwood logs to a stave mill at Aitkin. Several small gasoline launches help at times in carrying merchandise and passengers. By far the greater tonnage carried by this stretch of the river is the running of loose logs, poles, and pulp wood, of which 255,000,000 feet, board measure, valued at $5,100,000, passed downstream during the season 1908.

Manufacturing plants.—At Aitkin there are three sawmills, two stave mills, and a creamery. On the river between Aitkin and Grand Rapids there are four small sawmills. There being no manufacturing plants at Grand Rapids, business is confined to the supplying of the settlers with the necessities of life.

There is a real demand for navigation on this portion of the Mississippi River. The settlers along the banks are dependent on the boats for supplies and for means of getting their produce to market. Since the work of improvement ceased in November, 1906, the river has been steadily deteriorating, owing to the accumulation of logs and snags, erosion of the banks, etc. Boats are still able to use the channel, but with increasing difficulty from year to year.

MISSISSIPPI RIVER, ST. PAUL TO MINNEAPOLIS, MINN.

Report on a recent examination is printed in House Document No. 741, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, March 5, 1910.

SIR: The river and harbor act of March 3, 1909, provides for an examination of "Mississippi River, from Saint Paul to Minneapolis, with a view to modification of project to provide for increased depth and utilizing the surplus water for development of power."

The duty of making this examination was committed to a special board of officers of the Corps of Engineers, whose full and comprehensive report thereon I have the honor to submit herewith for transmission to Congress.

The present approved project for the improvement of the Mississippi River between St. Paul and Minneapolis provides for the construction of 2 locks and dams and for securing a depth of 6 feet at low water. The depth originally projected was 5 feet at low water, but was increased to 6 feet by the river and harbor act of March 2, 1907, which necessitates some changes in the original plans for the locks and dams. Lock and Dam No. 2 has been completed and is now in use, and Lock No. 1 has also been built but the dam at the latter is yet to be constructed. To secure the increased project depth of 6 feet it is proposed to use flash boards at Dam No. 2, to raise Dam

No. 1 about 1 foot, and to construct an auxiliary lock of small lift below Lock No. 1 for use at extreme low water. The board is of the opinion that a depth of 6 feet at low water is sufficient for the present needs of commerce; consequently, further modification of the project will be unnecessary if existing commerce alone is to be provided for.

The development of water power, however, if added to the scheme of improvement will necessitate further changes from the present plans, as the two dams, if completed as originally projected, with 13-foot lifts, will not be adequate for this purpose. The board believes, however, that by building Dam No. 1 (which has not yet been commenced) with a lift of 30 feet, ample provision would be made for the economical development of water power to the extent of about 15,000 horsepower. To build such a dam and raise the lock would cost about $200,000 more than to complete the present project as planned, with a low dam at Lock 1, assuming the cities of St. Paul and Minneapolis grant flowage easements over their lands, and in view of the fact that the cheaper plan will, when constructed, carry out the project adopted by Congress for a 6-foot waterway, the board feels that the legality of this additional expenditure by the United States, although affording improved facilities for navigation, is not free from doubt in so far as it may be considered as for the purpose of water-power development. While the board does not recommend that the construction of a single high dam be undertaken by the United States alone, it is convinced that the change from a low to a high dam would be of great benefit, and that it should be carried out now in cooperation with State or municipal agencies. To this end the board has been in conference with representatives of the cities of St. Paul and Minneapolis, who have expressed a willingness to cooperate with the United States and to bear the increased cost of the scheme.

This proposition is fully discussed in the report, and as a result of thorough consideration the board recommends that specific legislation be enacted to carry it out.

The Board of Engineers for Rivers and Harbors has reviewed the conclusions and recommendations of the special board and concurs in the proposition for municipal cooperation and for the necessary legislation as advanced by said board, with one or two minor exceptions. It is also of opinion that lowering the floor and miter sill of the existing lock, even at additional cost, is preferable to the construction of an auxiliary lock. The additional cost has been estimated at approximately $30,000.

There is no question that a single dam with a lift of approximately 30 feet would have many advantages over the present system of two locks and dams. It would give a depth of 9 feet at the head of navigation at Minneapolis, which would probably meet the needs of all future navigation; it would be easier and cheaper to maintain and operate; would provide better facilities for the passage of vessels; and would create a valuable water power which could be utilized to pay the cost of construction as well as of future maintenance and operation, and produce a perpetual surplus revenue for the Government.

Furthermore, I am convinced that the construction of such a lock and dam by the Government alone is feasible, practicable, and legal under existing conditions. It is true that the existing project has been partially completed, and when completed will suffice for the present needs of navigation, but there is no assurance that this project will not need considerable further enlargement for navigation purposes within a few years. As a matter of fact, it has already been enlarged once since its original adoption, and no one can say with certainty that a depth of 7, 8, or even 9 feet will not be actually demanded in the near future. It is not unusual for Congress to provide for reasonably prospective, as well as for existing commercial needs, and in many cases where it was not provided for it would have been wise, as well as economical, to have done so.

To make such a change in the project now will entail an additional expense of $230,000, including all flowage rights except those owned and controlled by the cities of St. Paul and Minneapolis, and at no time in the future can it be accomplished so economically. This additional expenditure can be recovered in a short time from the utilization of the water power which would be incidentally created. Moreover, the creation of water power at this locality would be of special advantage to governmental interests other than those of navigation. It is understood that for the Fort Snelling Military Reservation, in the immediate vicinity, the Government is paying about $15,000 annually for electric power generated and furnished by private enterprise, and that large sums are also expended for similar service in the various public buildings in the two cities of St. Paul and Minneapolis. The water power resulting from the improvement could be applied to meeting these expenses, either directly, by means of a Government plant, or indirectly, through leases to municipal or private corporations; and, aside from the question of an improved navigation, there would seem to be no doubt of the wisdom of providing for such expenditures in the manner proposed, nor of the constitutional power of Congress to do so.

I am constrained therefore to conclude: (*a*) That from the standpoint of navigation and other Federal interests, it would be advisable to modify the existing project in such manner as, while better serving those interests, will permit the creation and utilization of a valuable water power which can be applied to minimizing the cost of construction; (*b*) that instead of inviting the cooperation of and entering into contractual relations with any private or municipal corporations for the execution of the work (a policy which experience has shown to be conducive to friction and misunderstanding, and often attended by serious complications), the cost of construction should be borne by the United States alone so that the control of the water power will be absolute, and it may be used, leased, or otherwise utilized as may be most advantageous to interests of the Government.

To carry out the foregoing proposition, I recommend that Congress make provision for constructing a high dam and modifying the present lock in lieu of building a low dam and an auxiliary lock. The cost of constructing a high lock and dam will exceed the cost of completing the present project, modified as recommended by the Board of Engineers for Rivers and Harbors, as follows:

Thirty-foot lock and dam (including lowering floor and miter sill of existing lock)	$200,000
Flowage rights over private lands	80,000
Flowage rights over city lands	100,000

From this should be deducted the cost of repair and reconstruction of Lock and Dam No. 2, which will be necessary if the present project is adhered to and which is estimated at $50,000. A still further reduction may be made by obtaining the easement of flowage over city lands at a nominal cost. The two cities of St. Paul and Minneapolis are deeply interested in the construction of a high lock and dam, and in addition are naturally the most desirable lessees of any surplus power that may be created thereby. Through assurances of reasonable and proper concessions to them in the matter of leasing such surplus power it is thought to be possible to secure a voluntary donation of the right of flowage over their lands. It is therefore recommended that negotiations to this end be had with the proper agencies of these municipalities before resorting to condemnation proceedings, which would be both tedious and costly.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

MISSISSIPPI RIVER HEADWATERS.

CANAL, LAKE WINNIBIGOSHISH AND LEECH LAKE, MINNESOTA.

Following is the letter of the Chief of Engineers submitting report on a recent survey printed in House Document No. 363, Sixty-first Congress, second session:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, November 18, 1909.

SIR: I have the honor to submit herewith for transmission to Congress reports of June 17 and August 5, 1909, with map, on preliminary examination, with plan and estimate of cost of improvement, authorized by the river and harbor act approved March 3, 1909, of reservoirs at headwaters of Mississippi River, with a view to an equalizing canal with regulating gates between Lake Winnibigoshish and Leech Lake.

There has been expended on the reservoir system at the headwaters of the Mississippi River approximately $1,500,000. In order to permit more efficient conservation and distribution of the waters in the reservoirs by permitting the surplus waters of Lake Winnibigoshish to be stored in Leech Lake and used when most needed, it is proposed to connect these two bodies of water by a canal at an estimated cost of $61,200. This amount includes the cost of construction of controlling works and three bridges necessary to be built over the proposed canal.

I concur with the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors that this canal is worthy of construction as a part of the reservoir system at the headwaters of the Mississippi River.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

Lake Winnibigoshish, having a capacity of 44,000,000,000 cubic feet, has at times been full, and the water which has at such times run to waste has subsequently been

needed for navigation purposes. Leech Lake, on the contrary, with a nominal capacity of 33,000,000,000 cubic feet, has never been full even in the worst flood years. The object of the proposed canal connecting these two lakes is to remedy this undesirable condition by permitting more efficient conservation and distribution of the water.

MISSOURI RIVER AT ATCHISON, KANS.

Report on a recent survey is printed in House Document No. 700, Sixty-first Congress, second session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., February 4, 1910.

Respectfully returned to the Chief of Engineers, U. S. Army.

The district officer presents herein a project for the improvement of the Missouri River in the vicinity of Atchison, Kans., the object of which is to direct the channel through the draw span of the bridge at that city and rectify the undesirable conditions that have existed above the bridge for the past few years, and which at times have been so bad as to threaten a total suspension of navigation.

It is proposed to train the channel toward the bridge by means of a system of permeable dikes. The estimated cost of the project is $180,000 if the dikes are built of timber piles, and $225,635 if concrete piles are used. The district officer is of opinion that the improvement is advisable, but in view of the interests involved other than those of navigation he believes that one-half of the cost of the work should be borne by those interests. The division engineer concurs as to the advisability of the improvement, but suggests a modified plan, which he estimates would cost about $70,000.

The river at this locality has been the source of a great deal of trouble for many years, and large sums have been expended for its improvement both by the General Government and by private parties. Various plans have been tried, none of which have been entirely successful. Experience here, as elsewhere on the Missouri River, has demonstrated that frail or temporary structures can not be relied upon.

In the opinion of the Board the plan proposed by the district officer is none too strong, and it recommends its general features for adoption. It believes, however, that the plan is too radical in its encroachment upon the present channel, which it attempts to force rather than to guide. The Board has laid down in red on the map accompanying a line of easier curvature for the longitudinal dike, which under conditions now existing would, in its opinion, be safer to follow. While it recognizes that the approach to the bridge by this line is not quite so good as by the one proposed by the district officer, work following this line would probably be attended by a much greater measure of success. It is therefore recommended for present adoption. Altered conditions by the time work is commenced may require a further modification, and the project should be elastic in this respect.

While present conditions indicate that some saving would be effected in the length of the cross dikes, it is believed to be inadvisable to undertake the rectification of the river at this point at a less cost than proposed by the district officer for the timber-dike system, namely, $180,000. If changed conditions make it possible to effect a saving, it would permit the use of concrete piles for a part of the work, and this should be authorized.

As explained by the district officer, there is but little through commerce on the Missouri River, and the improvement of the channel over so short a reach at the cost here involved would not ordinarily be deemed advisable. In this case, however, the total suspension of navigation is threatened, and for this reason the Board believes the improvement should be undertaken. The principal trouble here is due to the existence of a bridge, and it is manifestly to the interests of the owners of this bridge to have the work now contemplated carried into effect.

The Board concurs with the district officer in the opinion that these or other interests should share in the expense of the work, and it recommends that it be undertaken by the General Government on condition that these interests furnish one-half the estimated cost. If they are unwilling to do this, it is recommended that steps be taken to have the bridge altered so as to provide for safe navigation through it, and that no work of river improvement be undertaken.

The district officer describes existing wharves and terminal facilities, and attention is respectfully invited to his remarks on this subject. In compliance with the provisions of section 13 of the act of March 3, 1909, the Board reports that there are no questions of water power or other subjects so related to the project proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures made in the interests of navigation.

MISSOURI RIVER NEAR ST. JOSEPH, MO.

Report of a more recent survey than that summarized at page 606 is printed in House Document No. 750, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, March 4, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated May 1, 1909, and February 17, 1910, by Maj. Edward H. Schulz, Corps of Engineers, on preliminary examination and survey, respectively, called for by the river and harbor act approved March 3, 1909, of Missouri River, at or near Lake Contrary, Missouri, with a view to preventing a diversion of the channel.

A report of the conditions on the left bank of the Missouri River near Lake Contrary was made December 26, 1907, and published as House Document No. 824, Sixtieth Congress, first session, under the title "Missouri River at St. Joseph, Mo." The report now submitted is largely a review of the previous one, with the additional information obtained during the past two years, and as a result of his further investigation the district officer renews his recommendation as set forth in said document, viz, for improvement at the locality by construction of 16,500 feet of revetment between points A and C shown on map accompanying said document at an estimated cost of $150,000, with $3,000 annually for maintenance. He is of opinion that the improvement is necessary in the interests of navigation, and recommends that it be done at the expense of the General Government, although various interests are involved which warrant participation by them in the cost of the work. The division engineer agrees with the district officer that the proposed improvement is advisable, but he states that as this is a case in which real estate properties will be benefited fully as much or more than immediate navigation, it is one where the local community should cooperate under State, county, city, or other direction.

These reports have been considered by the Board of Engineers for Rivers and Harbors, and in its report dated February 28, 1910, herewith, the Board states that the improvement is advisable. It believes, however, that local interests at St. Joseph and vicinity will reap even greater benefits than navigation interests, and for this reason that such interests should share in the cost of the work. The Board recommends therefore that the improvement be undertaken by the General Government on condition that one-half the estimated cost is borne by the local interests.

I concur in the views and recommendation of the Board of Engineers for Rivers and Harbors.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

CHANNELS CONNECTING MOBILE BAY AND MISSISSIPPI SOUND, ALABAMA.

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 967, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., April 27, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

As stated in the report on preliminary examination, two routes particularly suggest themselves for providing a navigable channel 10 feet deep connecting Mobile Bay with Mississippi Sound. One of these routes is known as Grants Pass, which, under authority given in 1839 by the legislature of Alabama, was improved by private parties, who have since charged tolls for its use. The other route is known as Pass aux Herons, and is nearly, if not quite, as favorably situated for commercial purposes as the route controlled by private interests. The physical conditions are so nearly equivalent that no difference in the cost of maintenance of one over the other need be considered.

The district officer states that the purposes indicated by the act ordering this investigation, namely, the construction of a channel 10 feet in depth between the bodies of water specified, can be accomplished by dredging to a width of 100 feet from the 10-foot contour in Mobile Bay, where the bottom is somewhat hard, to the 8½-foot

contour in Mississippi Sound, where the bottom is soft mud, through 1 or 2 feet of which a vessel can push without difficulty. He estimates the cost of such a channel following the most favorable water via Pass aux Herons, at $49,359.90, while a similar channel via Grants Pass is estimated to cost $47,587.80, both estimates including 20 per cent for contingencies.

Having in mind the probable cost of securing the right of way through Grants Pass, with its attendant litigation and delay, the Board believes that the channel through Pass aux Herons would prove to be the more economical and advantageous to the United States. Comparing the present and prospective commerce of the locality with the sum needed to secure this channel, the Board believes that the requisite expenditure is justified. It therefore concurs with the district officer and the division engineer in recommending the construction of the channel via Pass aux Herons, as proposed by the district officer, at an estimated cost of $49,359.90.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

Between 1828 and 1830 the channel known as Pass aux Herons was partially dredged by the Government through this obstructing shoal, but no other work has been done by the United States at this locality, although two examinations were subsequently made and improvements recommended. Such traffic as has followed this route has passed through the shoal by way of Grants Pass, which is a private channel, for the use of which tolls are collected. The commerce passing between Mobile Bay and Mississippi Sound during 1906 is reported at 63,929 tons, valued at $631,091.52. It is stated that the private waterway through which this commerce passes is of insufficient capacity to accommodate the traffic now seeking this route, and that a substantial increase would probably follow the opening up of a deeper and more commodious channel through the shoal, available to navigation without charge.

NANTICOKE RIVER, DELAWARE AND MARYLAND.

Report on a recent survey is printed in House Document No. 674, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers, submitting the same.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, February 8, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated June 4, 1909, and January 13, 1910, by Lieut. Col. W. E. Craighill, Corps of Engineers, on preliminary examination and survey, respectively, called for by the river and harbor act of March 3, 1909, of Nanticoke River, Delaware and Maryland, up to Middleford.

The adopted project for the improvement of Nanticoke River provided for a channel 9 feet deep at mean low water and 100 feet wide, increased to 150 feet at sharp bends in the channel, the improvement to extend to within 100 feet of the county bridge at Seaford, where it widens out fan-shaped. This work has been completed, and the additional work required is for maintenance.

The district officer states that from the facts developed by the survey he is of opinion that no modification of the project, either in depth, width, or alignment, is necessary at this time to meet the requirements of the commercial and other interests involved—both present and prospective—except a slight widening of the channel between the bridges in the harbor at Seaford, which he estimates will cost $2,860. In view of the exceedingly small cost of this improvement and the great prospective benefits, he recommends that this modification be adopted, and in this view the division engineer concurs.

These reports have been considered by the Board of Engineers for Rivers and Harbors, pursuant to law, and the Board concurs with the district officer and the division engineer in the opinion that the needs of commerce do not require or justify an increase of depth in this stream at the present time, but that the proposed widening between the bridges in the harbor of Seaford, at an estimated cost of $2,860, is advisable in the interests of commerce and navigation, and recommends that the existing project be modified accordingly.

I concur in the opinion of the Board.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

The following is an extract from the report of the local officer:

The commerce by water (statistics furnished in part by the Baltimore, Chesapeake and Atlantic Railway Company) for the entire river for the year ended May 1, 1909, was 132,842 tons, valued at $7,740,155, carried in 3 steamers and 105 sailing vessels and barges, having a total tonnage of 9,737. The commerce is local and consists of lumber, wood, melons, fruit, berries, canned goods, fertilizer, coal, grain, general merchandise, agricultural products, poultry and live stock, fish, oysters, new sailing vessels, and barges. The commerce of Sharptown and Seaford by water for this period amounted to 43,904 tons, valued at $2,086,825. The commerce by rail for Seaford, which is mostly with Philadelphia and northern points, amounted to 27,880 tons, valued at $1,663,500, for the same period, the outbound commodities being principally oysters, berries, melons, potatoes, and lumber. The prospective commerce of the river will be that due to natural growth. Besides this there has been a marked improvement recently in the shipbuilding and lumber business, due to the construction of extensive shipyards and erection of a large lumber and box mill at Seaford.

NEWPORT HARBOR, RHODE ISLAND.

The following is from House Document No. 610, Sixty-first Congress second session:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, January 28, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated April 17 and December 18, 1909, with map, by Lieut. Col. J. C. Sanford, Corps of Engineers, on preliminary examination and survey, respectively, called for by the river and harbor act approved March 3, 1909, of Newport Harbor, Rhode Island, with a view to the modification and enlargement of the existing projects as indicated in plans B and C contained in House Document No. 438, Fifty-ninth Congress, second session.

The existing project for the improvement of Newport Harbor adopted in 1907, and under which work is now in progress, provides for dredging a channel 750 feet wide and 18 feet deep at mean low water around the southerly end of Goat Island and northward through the harbor, for the extension of the 13-foot anchorage area southward to the harbor line, and for the removal of Nourmahal rock.

The district officer now submits three plans for further improvement, as follows:

(*a*) For dredging to a depth of 18 feet all of the area covered by project C, including certain rock removal, estimated to cost $271,000, with $6,000 annually for maintenance.

(*b*) For dredging as above, but omitting the area on the Goat Island side of the 18-foot channel, which work, for reasons given, the district officer believes inadvisable. He estimates the cost at $247,000, with $5,000 annually for maintenance.

(*c*) For improvement as in (*b*) modified by providing a curved junction of the project line on the south with the 18-foot channel on the east of Goat Island and omitting the rectangular area at the north end of the harbor on the city side which contains the rock and which, on account of the large cost for its removal as compared with the benefits to be derived, should, in the opinion of the district officer, be omitted. The estimated cost of this plan is $233,000, with $5,000 annually for maintenance.

The district officer recommends for adoption the project last described, and the division engineer concurs in the recommendation of the district officer, except in the omission of the area on the east side of Goat Island. He believes that this should be included in the area to be dredged, so as to enlarge the harbor as much as possible.

The Board of Engineers for River and Harbors concurs in the opinion that the locality is worthy of further improvement and recommends that the existing project be modified so as to include all the dredging to a depth of 18 feet contemplated in project C (H. Doc. No. 438, 59th Cong., 2d sess.), excepting that on the east side of Goat Island and that on the Newport city side of the harbor north of the line Y–Z shown on the map, at a cost, as estimated by the district officer, of $233,000.

Attention is invited to the remarks of the Board relative to the recommendations of the district officer in regard to additional wharf facilities which he deems necessary for the full use of the proposed improvement of the harbor.

I concur in the recommendation of the Board.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The following is from the report of the Board:

The Board invites attention to the remarks and recommendations of the district officer in regard to additional public wharf facilities he deems necessary for the full use of the proposed improvement of the harbor. Section 13 of the act of March 3, 1909, calls for "such data as it may be practicable to secure regarding * * * the establishment of terminal and transfer facilities," but as it is not understood that Congress has as yet adopted the policy of making river and harbor improvements conditional upon the existence or the establishment of public wharves, the Board does not wish to recommend at this time that this locality be required to make the improvements suggested.

The local imports and exports for the calendar year 1908, including transshipment to the railroad of freight brought by water, amounts to about 202,530 tons, with a value of about $9,246,164. Of this amount, about 118,000 tons is coal, of which about three-fourths is anthracite. All the coal is brought from New York Bay points on barges and schooners, much the larger part being on barges; but all of these vessels are necessarily of light draft, as vessels drawing more than about 12 feet can not reach the wharves at all times. These light-draft vessels are uneconomical as compared with the larger ones and are becoming scarce and difficult to obtain, the tendency in construction being toward larger vessels.

NORFOLK HARBOR AND APPROACHES, AND NEWPORT NEWS, VA.

Summary of House Document No. 551, Sixty-first Congress, second session, is printed in this report, page 184. Report on a recent survey is printed in House Document No. 550, Sixty-first Congress, second session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., January 5, 1910.

Respectfully returned to the Chief of Engineers, U. S. Army.

The existing project for the improvement of the channel through Newport News Middle Ground bar, adopted by the act of June 13, 1902, and completed in 1905, provides for a depth of 30 feet and a width of 500 feet. The present investigation was ordered with a view to providing a depth of 35 feet through this bar, and in the within report on a survey of the locality the district officer submits three plans for accomplishing the contemplated improvement.

Projects Nos. 1 and 2 are for channels of the prescribed depth and widths of 500 feet, the former having four tangents and the latter five tangents. Channel No. 3 is located north of the Newport News Middle Ground light, and, because this channel is straight and easy to follow, a width of 400 feet has been deemed sufficient. The estimated costs are $457,800, $456,000, and $465,000, respectively. While Channel No. 3 is a little more expensive than the other two, the district officer believes that its superior advantages more than offset the difference in cost, and in this view the Board concurs.

The commerce of Newport News is large and important, being reported as amounting in 1907 to 6,379,617 tons. It appears that the capacity of the existing 30-foot channel has been fully utilized, and it seems certain that the provision of the deeper channel now proposed will result in the use of a greater number of deep-draft vessels, with attendant advantage to commerce and to the general public. After due consideration of all the facts available, the Board concurs with the district officer in the opinion that it is advisable for the United States to undertake the construction of a channel 35 feet deep and 400 feet wide at mean low water, in accordance with project No. 3 submitted within, at an estimated cost of $465,000, provided, however, that a similar deepening of the entrance channel to Hampton Roads, recommended in the Board's indorsement of this date on the report of a survey of Norfolk Harbor, be also approved, this deepening being essential to the utilization of the contemplated channel across Newport News Middle Ground.

The district officer has given preliminary consideration to the question of terminals, and states that he proposes to give further study to this matter, and, at a later date, to submit a report embodying any recommendations which it may then seem well to make. In compliance with section 13 of the act of March 3, 1909, the Board reports that there are no questions of water power involved at this locality, and in its opinion

there are no other subjects so related to the project herein recommended that they could be advantageously coordinated therewith in the interests of commerce and navigation.

For the Board:

WM. T. ROSSELL,
Colonel, Corps of Engineers,
Senior Member of the Board.

CHANNEL FROM THE INLAND WATERWAY BETWEEN NORFOLK AND BEAUFORT INLET TO THE TOWN OF BEAUFORT, N. C.

Report on a recent survey is printed in House Document No. 511, Sixty-first Congress, second session. The following report of the Board of Engineers is concurred in by the Chief of Engineers:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., December 21, 1909.

Respectfully returned to the Chief of Engineers, U. S. Army.

Estimates are submitted within for both channels under consideration for widths of 60 feet, as specified in the act, and also for widths of 100 feet, the latter being deemed advisable by the district officer and the division engineer. There are two possible routes for the upper channel, one joining the inland waterway at the second angle above Morehead City, the other at the third angle.

For reasons given, the district officer recommends as advisable only the channel leading toward the north, known as Gallants channel, and he selects the one entering the inland waterway at the second angle. The division engineer is of opinion that neither channel is worthy of improvement by the United States, but that if anything is done the southerly or Bulkhead channel should be chosen.

The commerce to be affected by the proposed improvement is not at present extensive, but the completion of the waterway from Pamlico Sound to Beaufort will, however tend to increase inland traffic with Beaufort, and the Board believes that this will add to its importance sufficiently to justify the United States in constructing one of the channels now under consideration.

Interested parties were given an opportunity of presenting their views to the Board. A number of communications have been received, and on December 13, 1909, a hearing was held in the office of the Board which was attended by Hon. F. M. Simmons, United States Senator, Hon. C. R. Thomas, Member of Congress, and a delegation of citizens of Beaufort. Those interested desire the improvement of both channels, but they appear to be unanimously in favor of the upper or northerly channel if only one is deemed worthy of improvement.

Based upon all information now available, the Board has arrived at the conclusion that the commercial and navigation interests involved are sufficient only to justify the improvement of one of the channels under consideration and that these interests will be best served by the northerly channel. It believes further that the channel entering the inland waterway at the third angle should be chosen in the interests of economy of maintenance.

The wording of the act indicates that Congress had in mind a channel width of 60 feet, and the Board is of opinion that if such a channel is properly marked it can be successfully followed by the class of vessels that will use this waterway. Moreover, it will be entirely practicable to widen it if it should be found advisable in the future to do so. The district officer estimates the cost of this channel at $27,676. He estimates the cost of maintaining the channel entering the inland waterway at the second angle at $1,500 annually. That amount should maintain the channel entering at the third angle more effectually.

In view of the foregoing, the Board recommends the improvement of the upper channel 10 feet deep and 60 feet bottom width, by the route entering the inland waterway at the third angle, at a first cost of $27,676, and $1,500 thereafter for maintenance.

In compliance with the provisions of section 13 of the act of March 3, 1909, the Board reports that there are no questions of terminal facilities, water power, or other subjects so related to the project proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures made in the interests of navigation.

For the Board:

WM. T. ROSSELL,
Colonel, Corps of Engineers,
Senior Member of the Board.

The commerce of Beaufort Harbor for the year 1898 amounted to 46,178 tons, valued at $2,136,000.

NORFOLK-BEAUFORT INLET WATERWAY, VIRGINIA AND NORTH CAROLINA.

The following is from House Document No. 84, Fifty-ninth Congress, second session:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, September 27, 1906.

SIR: Under authority conferred by joint resolution of Congress approved June 30, 1906, I have the honor to submit herewith for transmission to the Public Printer report of May 9, 1906, with map, by a special Board of Engineers on examination and survey authorized by section 9 of the river and harbor act approved March 3, 1905, as follows:

"Inland waterway from Norfolk, Virginia, to Beaufort Inlet, North Carolina, with a view to obtaining a channel of a depth of ten and twelve feet, respectively, upon the most advantageous route between the points named. Such examination and survey shall be made by a board of engineer officers detailed by the Secretary of War, and they shall report upon the character and probable cost of any private waterways which it may be desirable to acquire in connection with or as a part of the proposed improvement."

This Board was composed of Lieut. Col. Smith S. Leach, Capt. (now Maj.) C. A. F. Flagler, and Capt. G. P. Howell, all of the Corps of Engineers, and the investigation made by it is supplementary to that with a view to the construction of a channel not less than 16 feet in depth between the same terminal points, authorized by the river and harbor act of June 13, 1902, report on which is printed in House Document No. 563, Fifty-eighth Congress, second session (also Annual Report of the Chief of Engineers for 1904, p. 1387).

The object of the present investigation is specifically stated in the item of law above quoted, and the Board has addressed itself to a consideration of the objects therein mentioned, making use of the data furnished by the previous examination and survey. Attention is respectfully invited to the conclusions of the Board as summarized in the closing paragraphs of its report.

As required by law, this report has been referred for review and recommendation by the Board of Engineers for Rivers and Harbors connected with this Office. The report of this latter Board is embodied in a separate paper herewith, dated June 29, 1906, and its findings are as follows:

"The Board recommends the adoption of the project outlined by the special Board to secure an inland waterway 12 feet in depth between Norfolk, Va., and Beaufort Inlet, North Carolina, at a cost of $2,900,425, plus the cost of the Albemarle and Chesapeake Canal; but in case the said private waterway can not be purchased for a sum not exceeding $500,000, it recommends for the upper stretch the new cut via Cooper Creek, making the total estimated cost $3,378,055. The Board agrees with the special Board that the maintenance of the proposed waterway is impracticable under the contract system, and that it should be carried on by the continuous operation of a plant owned by the Government, the estimate for which is placed at $290,000 for first cost and $73,000 thereafter for annual operation."

I concur in the views and recommendations of the Board of Engineers for Rivers and Harbors.

Very respectfully,

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

Hon. WM. H. TAFT,
Secretary of War.

OUACHITA RIVER, ARKANSAS.

UNITED STATES ENGINEER OFFICE,
Vicksburg, Miss., October 19, 1909.

SIR: Your letter of 16th instant has been received, in which you make inquiry in reference to report on the stretch of Ouachita River from Camden to Arkadelphia, and the action taken thereon by the Board of Engineers for Rivers and Harbors.

In reply thereto will say that the following is a copy of the action taken by the Board of Engineers in reference to the report, and which gives a brief summary of the matter:

"The Ouachita River is now being improved by the United States under a project providing for the construction of 9 locks and movable dams, to afford a navigable depth of 6½ feet from the mouth of Black River, La., to a point 10 miles above Cam-

den, Ark., a total distance of 360 miles. The present investigation was ordered with a view to extending navigation from Camden to Arkadelphia.

"The district officer states that between these two points, the slope is steep, the current is swift, numerous gravel shoals exist, and many trees have caved into the channel; but there is sufficient water for the navigation of light-draft boats when the stage at Camden is from 10 to 15 feet, or generally from December to May.

"From the facts presented it appears that a radical improvement of the stream by locks and dams similar to that below Camden would require an expenditure wholly out of proportion to the benefits to commerce and navigation which might reasonably be expected therefrom. The district officer is of opinion, however, that the reach under consideration is worthy of improvement to the extent of removing snags, leaning trees, and similar obstructions. The Board concurs in this view and recommends that an estimate of cost for this work be called for.

"The district officer states that in this reach there are no cases where questions of coordinate development for navigation and water power arise. It appears, however, that about 10 miles northwest of Hot Springs, Ark., or about 60 miles above Arkadelphia, at a point on the Ouachita River, there is a favorable location for the construction of a dam which would impound a large volume of water, which, it may be, could be so controlled as to lessen flood heights, to some extent improve navigation on the reach now under consideration, possibly render the construction of locks below Camden unnecessary, and incidentally develop water power, available in inverse ratio to the demands of navigation upon the impounded water.

"How far the development of this water power and its utilization for industrial and commercial purposes can be coordinated with improvement of the Ouachita below Arkadelphia, and even below Camden (though the improvement of this latter section of the river is not under immediate consideration), so as to lessen the cost of this improvement or compensate for past expenditures thereon, can only be determined by a survey, by which would be determined the cost of the development, including the extent of damages due to flooded areas, the demand for and the value of the water power created, and the extent of local or other cooperation in carrying out the work. While it does not seem probable that the United States would be justified in assuming large expenditures toward such a project, this locality is reported as offering especially favorable opportunity for such a development, and in the opinion of the Board this question should be investigated in compliance with section 13 of the act of March 3, 1909.

"The Board therefore recommends that a survey be authorized with a view to determining the advisability of developing water power as above referred to; and that estimates of cost of such development, and of improving the river between Camden and Arkadelphia without such development, be prepared."

Complying with this action an estimate of $10,000 has been made by me as the cost of removing snags and obstructions from the channel, cutting trees along the banks, etc., and also, in accordance with my recommendation, an allotment has been made for a survey of the site of the location for constructing a dam about 10 miles northwest of Hot Springs. A party is at present in the field making this survey.

Very respectfully,

CLARKE S. SMITH,
Captain, Corps of Engineers.

Hon. MINOR WALLACE, M. C.,
Magnolia, Ark.

PLATTSBURG HARBOR, NEW YORK.

Report on a recent survey is printed in House Document No. 759, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, March 5, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated July 7, 1909, and January 12, 1910, by Lieut. Col. Edward Burr, Corps of Engineers, on preliminary examination and survey, respectively, called for by the river and harbor act approved March 3, 1909, of Plattsburg Harbor, New York.

This harbor has been improved by the United States under a project which contemplated the construction of a breakwater, dredging the shoal between the breakwater and the wharves, and revetment of the beach in front of the United States reservation

at Plattsburg Barracks. The breakwater has been constructed as projected, 1,565 feet long, but the revetment of the beach has not been undertaken, since the object sought can be obtained more economically by periodical dredging in the harbor. The dredging heretofore done has been in maintenance of the channel in front of the wharves to a depth of 9 feet below lake level.

The district officer presents a plan for improvement which includes repairing the breakwater, dredging areas not heretofore dredged, and redredging the channel in front of the wharves as shown on the map,[a] with a view to providing a depth of 9 feet at low lake level, all at an estimated cost of $25,500, with $2,000 annually for maintenance after completion until such time as radical repairs to the breakwater become necessary.

The division engineer concurs with the district officer in the opinion that this harbor is worthy of improvement, but he recommends that the project provide for an ultimate depth of 12 feet and the Secretary of War be authorized to expend any appropriations made for this project in such manner and for such work as would be required to provide for the needs of commerce best when the appropriation is available.

These reports have been considered by the Board of Engineers for Rivers and Harbors, and in its report dated January 31, 1910, the Board expresses the opinion that this harbor is worthy of improvement by the General Government in the manner indicated by the district officer at a cost of $25,500 and $2,000 for maintenance after completion.

I concur in the opinion of the Board.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

Plattsburg Harbor is one of the three most important ports on Lake Champlain, the other two being Burlington, Vt., and Whitehall, N. Y. Besides having a considerable commerce of its own it is a port of call, and to a certain extent of refuge, for the general traffic bound through the lake from Canadian to American ports. The commerce of the harbor has exceeded 250,000 tons per annum since 1902, no reliable statistics being available between 1895 and 1902. The commerce during the calendar year ending December 31, 1908, was 253,429 tons, of which nearly 90 per cent was general merchandise.

Shipments and receipts.

Articles.	1904.	1908.	Articles.	1904.	1908.
	Tons.	*Tons.*		*Tons.*	*Tons.*
Coal	11,000	6,904	Potatoes	1,080	500
Lumber	1,911	5,952	Apples	936	800
Brick	40	680	Ice		300
Stone		150	Pulp wood	140	12,466
Cotton	150		Merchandise	245,100	225,173
Iron	50	300			
Hay	700	204	Total	261,107	253,429

PROVINCETOWN HARBOR, MASSACHUSETTS.

Following is the letter of the Chief of Engineers, submitting report on a recent survey, printed in House Document No. 821, Sixty-first Congress, second session:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, March 25, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated July 6, 1909, and February 18, 1910, with maps, by Lieut. Col. Edward Burr, Corps of Engineers, on preliminary examination and survey, respectively, called for by the river and harbor act approved March 3, 1909, of Provincetown Harbor, Massachusetts, with a view to the protection thereof.

Work has been prosecuted by the General Government at this locality since 1826. Dikes, groins, and other sand-catching devices have been constructed in an effort to arrest the erosion and promote the accretion of the barrier of beach and sand dunes which protects and preserves the harbor.

The district officer now submits a plan for further improvement by the construction across House Point Island flats, from Stevens Point to Wood End, of a rubblestone

[a] Not printed.

dike 5 feet wide at the top, 15 feet above mean low water; also a 300-foot extension of the Long Point beach protection and bringing it up to grade where necessary, all at an estimated cost of $140,000.

I concur with the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors that this locality is worthy of further improvement by the General Government in the manner indicated.

Very respectfully,

FREDERIC V. ABBOT,
Acting Chief of Engineers.

The SECRETARY OF WAR.

The following is from the report of the local engineer:

The commerce of Provincetown is not large and in recent years has run from 27,000 to 30,000 tons per annum. The harbor is of importance mainly as an anchorage and a harbor of refuge, and in this respect the value is so great as to warrant the taking of such steps as may be necessary for its preservation. The number of vessels passing around Cape Cod is estimated to be greater than 50,000 per annum (Annual Report of the Chief of Engineers for 1904, p. 963), of which 4,000 are reported to seek shelter in this harbor. Vessels bound around the cape to and from northern New England ports find no port nearer than Boston, 40 miles to the northwest, and Vineyard Haven, nearly 100 miles to the southward. The harbor furnishes shelter in all weathers and has depths sufficient for all classes of vessels; but its principal importance is to small coasting vessels and to the fishing fleet, Georges Bank being but 115 miles distant to the eastward. To my mind there is no question as to the advisability of undertaking such works as may be necessary for the preservation of the harbor. The only question is as to the best method for securing that end.

I am, therefore, of the opinion that Provincetown is worthy of improvement by the United States in the interest of general commerce and with a view to its protection by preserving the point of Cape Cod that incloses it.

REDWOOD CREEK, CALIFORNIA.

Following is the letter of the Chief of Engineers submitting report on a recent survey, printed in House Document No. 307, Sixty-first Congress, second session:

WAR DEPARTMENT, OFFICE OF THE CHIEF OF ENGINEERS,
Washington, November 9, 1909.

SIR: I have the honor to submit herewith, for transmission to Congress, reports of July 2 and September 27, 1909, with map, by Lieut. Col. John Biddle, Corps of Engineers, on preliminary examination and survey, respectively, of Redwood Creek, California, authorized by the river and harbor act of March 3, 1909.

This stream has been under improvement since 1882, and under a project completed in 1903 there was obtained a channel 7 feet deep at low water and 100 feet wide through the middle ground, and 5 to 10 feet deep, 60 feet wide, and 150 feet long in front of the city wharf. No work has since been done and the improvement has gradually deteriorated.

The commerce to and from the several industrial establishments on the creek, it is stated, will immediately increase from 57,500 tons to 80,000 tons annually, and several large companies have signified their intention of moving to Redwood if deep water is secured. It is also stated that this community at present enjoys, on account of its water facilities, terminal railroad rates which it would lose if the creek became too shallow to navigate, and that industries already existent depend upon water transportation.

Two plans for improvement are presented to provide a channel 5 feet deep and 150 feet wide from San Francisco Bay to Redwood at a cost of $12,000, or a channel 10 feet deep at a cost of $31,500. The cost of maintenance is estimated at $1,500 annually.

I concur with the district officer, who is also division engineer and the Board of Engineers for Rivers and Harbors that the locality is worthy of improvement to the extent of providing the 5-foot channel.

Neither the establishment of terminal and transfer facilities, the development and utilization of water power for industrial and commercial purposes, nor any other subjects not considered in the reports are so related to the project as to be coordinated therewith to lessen the cost and to compensate the Government for any expenditure in the interest of navigation.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

From a report by the city trustees and board of trade the present commerce is 57,500 tons. It is also stated that if navigation were assured this would increase immediately to about 80,000 tons. It is further expected that, if there were sufficient water, other manufacturing establishments would locate on the creek.

There are several industrial establishments on the creek, such as a large tannery, fish-packing plant, salt works, lumber yards, etc. These use the creek generally to bring in supplies and have constructed wharfs to accommodate the shipping.

Besides the existing establishments several large lumber, foundry, and other companies have signified their intention of moving to Redwood if deep water is secured.

The new line of the Southern Pacific Railroad, almost completed, crosses the bay at Dumbarton Point, a short distance above Redwood, and it is anticipated that this will be an important factor in the growth of Redwood as an industrial center.

CANAL TO CONNECT REHOBOTH AND DELAWARE BAYS, DELAWARE.

The following report of the Board of Engineers on a recent survey is printed in House Document No. 823, Sixtieth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., March 13, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

The within is a report on a survey made for the purpose of formulating a project and estimate of cost of the work required "to connect by canal Rehoboth Bay with Delaware Bay at or near Lewes, through Lewes Creek and Gordon Lake," as specified by the act of March 2, 1907, ordering a preliminary examination of this locality. The cost of constructing a canal 6 feet deep at mean low water and 50 feet wide on bottom, narrowing to 40 feet where it passes through deep cutting, is estimated by the district officer to amount to $356,000, with an estimated cost for maintenance and operation of $7,500 per annum.

The route now selected from Rehoboth Bay to Gordon Lake follows that heretofore adopted and partially excavated for an inland waterway from Chincoteague Bay to Delaware Bay, but at Gordon Lake it swings to the east of the old line, and by avoiding certain points of highland and making greater use of the bed of Gordon Lake and of Lewes Creek and its tributaries, the cost of the canal throughout this section is considerably reduced. The new route again meets the old reservation near the southern limits of the town of Lewes, but leaves it at South Street Bridge and follows Lewes Creek to its junction with the Broadkill. The change of route now contemplated will necessitate the acquisition of certain lands not included in the reservation heretofore acquired. The cost of these lands, if they can be secured only by purchase, is estimated at $14,274. In addition to this sum, the estimate of the district officer includes $52,343.58 required to defray the cost of constructing two bridges, one at the crossing of the Delaware, Maryland and Virginia Railroad, and the other at the highway crossing about one-third of a mile south of the railroad.

From information developed by the survey, it appears that no unfavorable physical conditions exist throughout the selected route, and the improvement will therefore present no engineering difficulties. The currents which may be produced through the canal by fluctuations of level in Delaware Bay and Rehoboth Bay are believed to be insufficient to interfere with navigation or to necessitate any work of bank protection. As there will be but one level from bay to bay, and the tidal velocities will be inconsiderable, a lock will not be required at either terminus. These conditions combine to indicate a low maintenance charge, which in an artificial waterway of this character is usually a matter of considerable moment.

The commercial value of the improvement was thoroughly considered in connection with the preliminary examination, when the opinion was expressed by the Board that the advisability of constructing the canal depends upon its probable cost. Information as to the cost of the work and its maintenance being now available, the Board has reached the conclusion that the requisite expenditure is justified by the present and prospective commerce involved, and it concurs with the division engineer in recommending favorable consideration of the project presented within.

The Board believes, however, that the location of the canal should not be considered as definitely fixed on the line laid down in the report of the survey, but that latitude hould be left to the district officer to make final selection at the time of executing the work, in order that the improvement may be carried out with the greatest economy and dispatch.

For the Board:

H. F. HODGES,
Lieut. Col., Corps of Engineers,
Senior Member Present.

The Chief of Engineers, General Mackenzie, in submitting the report, says:

I concur in the opinion of the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors that this locality is worthy of improvement, leaving for Congress to decide how much, if any, of the expense shall be borne by local interests.

I recommend, however, that any appropriation to be made for this improvement shall be subject to the condition that no part of said sum shall be expended until any private individuals or corporations having the right under state or local authority to improve any of the waterways involved in this project shall have first surrendered or waived said right in a manner satisfactory to the Secretary of War.

In this connection attention is respectfully invited to the fact that the designation Lewes Creek has been changed by state legislative enactment to Lewes River.

The commerce that would follow Lewes Canal is, first, that to and from Lewes itself using only the portion of the canal that is now Lewes Creek; second, that to and from the shores of Rehoboth Bay, Indian River and Bay, and the canal itself, and that from the land lying on both sides of the canal cut from Indian River Bay to Assawaman Bay, and possibly some from the bays to the south—Assawaman, Sinepuxent, and Isle of Wight bays. All of these would use the entire length of the projected canal.

Major Flagler, in his report on preliminary examination, says:

I think it safe to say that the region affected by the Lewes Canal has a present commerce, import and export, of $9,000,000 per year; that half of this would follow the canal, and that the amount would be doubled within ten years.

ROCKPORT HARBOR, MAINE.

Following is the report of the Board of Engineers on a recent examination:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., February 24, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

It is estimated by the district officer that Harbor ledge, which is nearly in mid-channel at the entrance to Rockport Harbor, can be removed to a depth of 15 feet at mean low water at a total cost of $32,000. For reasons stated, no additional sum is estimated as necessary to remove the stone beacon which now marks the ledge. The improvement being of a permanent nature, no future expenditure for maintenance will be required.

In his report on the survey the district officer gives additional information as to the commerce of Rockport and the benefits to that commerce which may be expected from the proposed improvement. It appears that Rockport depends almost entirely upon water transportation for its freight shipments and receipts, and that a considerable proportion of its freight is carried in sailing vessels. To such craft the ledge is regarded as a dangerous obstruction to navigation, and its removal would not only afford a safer entrance for them, but would effect a considerable saving in towage charges. In view of these facts and the statements contained in the report of the Board reviewing that of the district officer on the preliminary examination, it is the opinion of the Board that the expenditure required to remove the ledge to a depth of 15 feet at mean low water is justified, and it concurs with the division engineer in recommending approval of the project presented for this work by the district officer.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

The engineer in charge of the examination in his report says:

Rockport Harbor, though small, is of very considerable commercial importance, due principally to its proximity to a large deposit of excellent limestone, one of the few available deposits in Maine. A narrow-gauge railroad, 2 miles long, connects the harbor with the quarries. A large pond, about one-half mile from the harbor, is utilized for harvesting ice, the shipment of which is a business of importance.

Considering that the value of the freight shipments and receipts of Rockport Harbor amount annually to more than $700,000 and that the removal of the ledge and beacon would render the approach to the wharves much easier and less hazardous for sailing vessels, I am of the opinion that the harbor is worthy of improvement by the General Government to the extent of $32,000, as herein estimated.

ROGERS CITY, MICHIGAN.

The following is printed in Rivers and Harbors Committee Document No. 28, Sixty-first Congress, second session:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, February 18, 1910.

SIR: Acknowledging receipt of your letter dated January 6, 1910, inclosing resolution of the Committee on Rivers and Harbors of the same date requesting the Board of Engineers for Rivers and Harbors to reexamine the report on preliminary examination of harbor at Rogers City, Mich., I have the honor to transmit herewith copies of the reports dated February 4, 1909, with map, by Col. C. McD. Townsend, Corps of Engineers, and February 9, 1910, by the Board of Engineers for Rivers and Harbors, in response thereto.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

Hon. D. S. ALEXANDER,
Chairman Committee on Rivers and Harbors,
United States House of Representatives.

WAR DEPARTMENT,
UNITED STATES ENGINEER OFFICE,
Detroit, Mich., February 4, 1910.

Respectfully returned to the Chief of Engineers, U. S. Army, inclosing a map showing the results of a survey at Rogers City, made January 27 to January 29, 1910, in compliance with instructions contained in the first indorsement hereon.

A channel 200 feet wide and 16 feet deep at the mean stage of Lake Huron (581.1) can be obtained across the bar by the excavation of 9,700 cubic yards. The material to be excavated consists of a top layer of bowlders, and underlaid to a depth of 18 feet with sand, gravel, and clay. Where dredges are available this material could be excavated for 25 cents per cubic yard, but due to the distance of the locality from any large city and its exposure to storms the estimated cost is placed at 60 cents per cubic yard, and the total cost of the improvement at $6,000. The cost of maintenance is estimated at $1,000 per year.

In addition to an existing commerce of about 20,000 tons per year in timber products, it is considered probable that a large commerce in limestone will be developed by the improvement sufficient to justify the expenditure.

In compliance with instructions contained in circular letter of November 23, 1909, I have to report that there are no wharves at Rogers City owned by the public, and that the nearest railway is about 12 miles distant. Since submitting my preliminary report, dated June 18, 1909, I have been informed that a single corporation has obtained possession, by purchase or lease, of the existing wharf privileges, but on what terms they propose to extend wharf privileges is unknown, and it is not believed there is space available for the construction of public wharves which could utilize the depth of channel proposed without extensive dredging.

C. McD. TOWNSEND,
Colonel, Corps of Engineers.

WAR DEPARTMENT,
BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., February 9, 1910.

SIR: 1. The Board has the honor to submit its report in compliance with the following resolution:

"*Resolved by the Committee on Rivers and Harbors,* That the Board of Engineers for Rivers and Harbors, created under section three of the river and harbor act approved June thirteenth, nineteen hundred and two, be requested to reexamine the report on preliminary examination of harbor at Rogers City, Michigan, printed in House Document Numbered Three hundred and fifty-two, Sixty-first Congress, second session."

2. It will be seen from an examination of the document referred to in the resolution that an extensive improvement involving a large probable expenditure was considered at the time that report was prepared. The commerce was not deemed sufficient to justify the improvement, and an adverse report was rendered.

3. It appears from information before the Board that those interested now desire only the dredging of a channel through the narrow reef that crosses the harbor about 500 feet out from the wharves, on which there is a least depth of about 12½ feet. If such an improvement were made it would permit vessels of 15-feet draft to reach the wharves, while under present conditions the draft is limited to about 12 feet.

4. The district officer estimates the cost of a channel 16 feet deep and 200 feet wide at $6,000, and its maintenance at $1,000 annually. There is at present a commerce of about 20,000 tons per year, and it seems probable that this amount may be materially increased in the future. In view of the foregoing, and the further fact that the locality is dependent to a great extent upon the water-borne commerce, the nearest railroad being about 11 miles distant, the Board believes that commensurate benefits would result from the moderate expenditure now desired, and it therefore recommends the construction of a channel 200 feet wide and 16 feet deep, as shown on the accompanying map, at an estimated cost of $6,000, with a probable annual maintenance charge of $1,000, provided that no work be undertaken by the United States until assurance is given satisfactory to the Secretary of War that suitable wharf and dock privileges will be extended to all on equal terms and at reasonable rates.

5. In compliance with the provisions of section 13 of the act of March 3, 1909, the Board reports that there are no questions of water power or other subjects so related to the project proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures made in the interests of navigation.

For the Board:

Very respectfully,

W. C. LANGFITT,
Lieut. Col., Corps of Engineers,
Senior Member Present.

The CHIEF OF ENGINEERS, U. S. ARMY,
Washington, D. C.

SABINE PASS AND PORT ARTHUR SHIP CANAL, TEXAS.

Following is the letter of the Chief of Engineers submitting report on a recent survey printed in House Document No. 773, Sixty-first Congress, second session.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, March 10, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated September 18, 1909, and January 21, 1910 (with maps), by Capt. A. E. Waldron, Corps of Engineers, on preliminary examination and survey, respectively, called for by the river and harbor act approved March 3, 1909, of Sabine Pass and Port Arthur Ship Canal, Texas, to and including Taylors Bayou and the turning basin at Port Arthur, with a view to widening said channels and said turning basin, and to obtaining increased harbor room of equal depth at Port Arthur; also a supplemental report dated February 10, 1910, by Captain Waldron.

The project adopted in 1882 for improvement of Sabine Pass provided for the construction of parallel jetties at the entrance of the pass, 1,800 feet apart and about 4 miles long from shore line to deep water in the Gulf, and for dredging a channel of practicable width and 25 feet deep between these jetties. The east jetty now has a length of about 25,270 feet, of which the outer 2,850 feet is mattress and foundation work only, and the west jetty a length of about 21,860 feet, of which 4,830 feet is mattress and foundation work only. At the time of the survey there was a channel between the jetties 90 feet wide and 25 feet deep, but the district officer states that it is improbable that this depth will be maintained, for to secure any considerable degree of reliability additional work in extending and building up the existing jetties will be required.

The Port Arthur Ship Canal, which extends from near the upper end of Sabine Pass to the mouth of Taylors Bayou, a distance of 7 miles, was dredged, between the years 1897 and 1899, by the Port Arthur Canal and Dock Company. It connects the deep water of Sabine Pass with a slip, a lumber basin 1,200 feet long and about 200 feet wide, and a turning basin 1,800 feet long and about 500 feet wide near Port Arthur. It was dredged originally to a bottom width of 75 feet and a depth of 25 feet at mean low tide, and has now a navigable depth of 24 feet.

The district officer submits plans for further improvement of these localities, as follows:

"(*a*) With a view to securing a channel 25 feet deep, with widths as proposed in the existing project from the Gulf to and including turning basins at Port Arthur, includ-

ing repair and extension of the jetties to the 25-foot contour in the Gulf, at an estimated cost of $2,373,350, with $155,000 annually for maintenance.

"(*b*) With a view to securing a channel 28 feet deep and 200 feet between the jetties, including repair and extension of the jetties to the 28-foot contour in the Gulf; widening where necessary, from the jetties to Port Arthur Canal, to 500 feet; widening the Port Arthur Canal to 150 feet bottom width and 28 feet depth; deepening the present turning basin to 28 feet; and providing a new and larger turning basin 600 feet wide, 1,700 feet long, and 28 feet deep, at an estimated cost of $5,625,000, with $335,000 for maintenance during the first year, this amount including the price of a new dredge, and $235,000 annually for maintenance after the first year.

"(*c*) With a view to securing a channel 30 feet deep, including repair and extension of jetties to the 30-foot contour in the Gulf, and dredging to 30 feet practically within the same limits as for the 28-foot project, except the additional length required, at an estimated cost of $6,950,000, with $360,000 for maintenance during the first year, this amount including the price of a new dredge, and $260,000 annually for maintenance after the first year."

The district officer favors plan (*b*) providing for a 28-foot depth and recommends its adoption. The division engineer deems it advisable to repair the jetties, enlarge the canal and turning basin, and if when that work is completed the depth of 25 feet is found insufficient, that an effort be made to obtain a greater depth by dredging alone, leaving the question of the actual depth to be obtained to await the port's commercial development during the time required for the above work.

These reports have been considered by the Board of Engineers for Rivers and Harbors, and the Board, recognizing the need of a more permanent and wider channel than has been available in the past, but not being convinced of the advisability of providing a greater depth than 25 feet at the present time, presents a project which it considers adequate for the present. This project includes the repair and building up of the jetties as far as the mattress foundation is laid, so as to provide a reasonably permanent channel of 25 feet navigable depth; dredging Port Arthur Canal 26 feet deep and 150 feet wide, and dredging a new turning basin 26 feet, 600 feet wide, and 1,700 feet long, all at an estimated cost of $2,000,000, with $290,000 for maintenance the first year, including the price of a new dredge, and $190,000 annually for maintenance thereafter. The Board recommends this project, but states that the right of way for the turning basin, estimated by the district officer to cost $10,000, should be furnished by local or other interests.

I concur in the views and recommendation of the Board of Engineers for Rivers and Harbors.

Very respectfully,

FREDERIC V. ABBOT,
Acting Chief of Engineers.

The SECRETARY OF WAR.

The following is from the report of the Board on the preliminary examination.

COMMERCIAL STATISTICS.

21. Following is a comparative statement showing character and amount of commerce passing through Sabine Pass jetty channel, also a like statement for Port Arthur Ship Canal, for the calendar years 1908 and 1909, respectively:

Sabine Pass, Texas.

VESSELS ENTERING AND DEPARTING.

Class.	1908.			1909.		
	Number.	Trips.	Net registered tonnage.	Number.	Trips.	Net registered tonnage.
Steamers	147	485	803,313	150	521	894,497
Sailing vessels	16	17	12,657	19	27	22,086
Barges	17	178	172,644	17	270	204,501
Total	180	680	988,614	186	818	1,121,084

Sabine Pass, Texas—Continued.

SHIPMENTS AND RECEIPTS BY WATER.

Articles.	1908.		1909.	
	Tons.	Value.	Tons.	Value.
Shipments:				
Crude petroleum	448,887	$2,565,068	564,192	$3,009,021
Partially refined petroleum	613,248	5,840,452	776,526	7,765,252
Refined petroleum	250,658	4,774,446	308,093	5,134,890
Lubricating oil	60,040	2,729,092	67,287	2,242,900
Asphalt	19,476	292,140	10,550	158,250
Cotton	26,790	5,358,800	42,169	10,963,875
Cotton-seed meal	22,026	396,468	17,565	351,300
Lumber and square timber	113,318	1,019,880	154,517	1,158,810
Logs, pine and walnut	2,879	59,050	1,427	8,550
Staves	10,058	230,969	5,252	131,287
Sulphur	192,044	3,456,792	211,503	4,230,060
Wheat	28,688	860,650	9,984	332,790
Corn	5,322	95,027	2,800	60,000
Rice and rice products	1,923	38,460	8,804	290,715
Miscellaneous	400	28,750	274	16,420
Total	1,795,757	27,746,044	2,180,943	35,854,120
Receipts:				
Creosote	1,000	25,000	.....	.....
Coal	1,000	5,000	.....	.....
Machinery and iron	3,000	225,000	3,000	225,000
Tin plate	1,500	150,000	.....	.....
Tropical fruits	.....	.....	972	20,000
Salt	.....	.....	871	17,420
Miscellaneous	50	2,500	.....	.....
Total	6,550	407,500	4,843	262,420
Grand total	1,802,307	28,153,544	2,185,786	36,116,540

Port Arthur Ship Canal.

VESSELS ENTERING AND DEPARTING.

Class.	1908.			1909.		
	Number.	Trips.	Net registered tonnage.	Number.	Trips.	Net registered tonnage.
Steamers	121	375	552,760	124	388	656,771
Sailing vessels	12	12	7,616	14	20	16,118
Barges	13	116	128,851	15	236	169,079
Total	146	503	689,227	153	644	841,968

SHIPMENTS AND RECEIPTS BY WATER.

	1908.		1909.	
	Tons.	Value.	Tons.	Value.
Shipments:				
Crude petroleum	223,363	$1,276,360	276,148	$1,472,790
Partially refined petroleum	409,317	3,898,252	712,240	7,122,396
Refined petroleum	250,658	4,774,446	308,093	5,134,890
Lubricating oil	60,040	2,729,092	67,287	2,242,900
Asphalt	19,476	292,140	10,550	158,250
Cotton	26,790	5,358,800	42,169	10,963,875
Cotton-seed meal	22,026	396,468	17,565	351,300
Lumber and square timber	108,045	972,414	129,800	973,440
Logs, pine and walnut	2,879	59,050	1,427	8,550
Staves, oak and cypress	10,058	230,969	5,252	131,287
Wheat	28,688	860,650	9,984	332,790

Port Arthur Ship Canal—Continued.

SHIPMENTS AND RECEIPTS BY WATER—Continued.

	1908.		1909.	
	Tons.	Value.	Tons.	Value.
Shipments—Continued.				
Corn	5,322	$95,027	2,800	$60,000
Rice and rice products	1,923	38,460	8,804	290,715
Sulphur	180	3,240	561	11,220
Miscellaneous	400	28,750	274	16,420
Total	1,169,165	21,014,113	1,592,954	29,270,823
Receipts:				
Creosote	500	12,500	.....	.....
Coal	200	1,000	.....	.....
Machinery and iron	3,000	225,000	3,000	225,000
Tin plate	1,500	150,000	.....	.....
Tropical fruits	.....	.....	972	20,000
Salt	.....	.....	871	17,420
Miscellaneous	50	2,500	.....	.....
Total	5,250	391,000	4,843	262,420
Grand total	1,174,415	21,405,118	1,597,797	29,533,243

The above statements are carefully prepared and show the total business done through the combined waterways during 1909 was largely in excess of that done in any previous year:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., March 1, 1910.

Respectfully returned to the Chief of Engineers, U. S. Army.

Based upon the results of the survey, the district officer submits estimates as follows:

"Channel 25 feet deep from the Gulf to and including turning basins at Port Arthur, widths as proposed in existing project, $2,373,350; maintenance, $155,000. This estimate provides for the repair and extension of the jetties to the 25-foot contour in the Gulf.

"Channel 28 feet deep, including repair and extension of jetties to the 28-foot contour in the Gulf, dredging channel 28 feet deep and 200 feet wide between the jetties, widening the channel where necessary from the jetties to Port Arthur Canal to 500 feet, widening the Port Arthur Canal to 150 feet bottom width and 28 feet depth, deepening present turning basin to 28 feet, and providing a new and larger turning basin, $5,625,000; maintenance, first year, $335,000, including the price of new dredge, and subsequent years, $235,000.

"Channel 30 feet deep, including repair and extension of jetties to 30-foot contour in Gulf, and dredging to 30 feet practically within same limits as for 28-foot project except the additional length required, $6,950,000; maintenance, first year, $360,000, including price of new dredge; subsequent years, $260,000."

The district officer believes the locality worthy of improvement in accordance with the plans proposed for the 28-foot depth. The division engineer deems it advisable to repair the jetties, enlarge the canal and turning basin, and if when that work is completed the depth of 25 feet is found insufficient an effort be made to obtain a greater depth by dredging alone, leaving the question of the actual depth to be obtained to await the port's commercial development during the time required for the above work.

In its study of this subject the Board has given consideration to a number of reports bearing upon the improvements already made and to data submitted both orally and in writing by interested parties. The Board is fully aware of the extent and character of the commerce involved and is impressed with its magnitude. It is also informed regarding the large expenditures already made by the General Government, and has carefully considered the estimates submitted for the further improvement deemed advisable by the district officer.

Recognizing the need of a more permanent and wider channel than has been available in the past, but not being convinced of the advisability of a greater depth than

25 feet on account of its great cost, at the present time, the Board requested and secured a supplemental estimate for a comprehensive project for a channel 25 feet in depth and of such widths as navigation demands. To meet these requirements the district officer presents a plan involving the extension of the jetties to the 25-foot contour, dredging a channel 26 feet deep and 200 feet wide between the jetties, 26 feet deep and 150 feet bottom width in the Port Arthur Canal, and dredging a new turning basin 26 feet deep, 600 feet wide, and 1,700 feet long, at a total estimated cost of $2,850,000, with $290,000 for maintenance for the first year, including the price of a new dredge, and $190,000 annually thereafter.

In the opinion of the Board, a channel of suitable width and 25 feet in depth can probably be obtained and maintained with the aid of dredging by extending the jetties only to the present ends of the mattress foundations, and after due consideration of all estimates and the nature of the commerce involved, 78 per cent being oil or its products, the production of which from existing fields may be expected to undergo the same changes that have occurred in other localities, it recommends as an adequate improvement for the present a reasonably permanent channel of 25 feet navigable depth and of suitable width, as follows:

(*a*) Repair and building up of jetties as far as mattress foundation is laid.	$1,385,400
(*b*) Dredging Port Arthur Canal, 26 by 150 feet	283,800
(*c*) Dredging new turning basin, 26 by 600 by 1,700 feet	141,800
Contingencies about 10 per cent	189,000
Total	2,000,000
Maintenance first year, new dredge	100,000
Jetty repairs	100,000
Operating dredge *Sabine*	30,000
Operating dredge in channels	60,000
Total	290,000
Subsequent maintenance	190,000

The right of way for the turning basin, estimated by the district officer to cost $10,000, should be furnished by local or other interests.

The district officer describes existing wharves and terminal facilities, and attention is respectfully invited to his remarks on this subject. In compliance with the provisions of section 13 of the act of March 3, 1909, the Board reports that there are no questions of water power or other subjects so related to the project proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures made in the interests of navigation.

For the Board:

WM. T. ROSSELL,
Colonel, Corps of Engineers,
Senior Member of the Board.

Following is an extract from the report of the Board on preliminary examination:

The Port Arthur Ship Canal extending from Sabine Pass to Taylors Bayou, a distance of 7 miles, was built by a private company. At its upper terminus a port has been established, with extensive terminal facilities. This canal was conveyed to the United States in 1906, since which time it has been maintained under the permanent indefinite appropriation for operating and care of canals and other works of navigation. The original depth of the canal was 25 feet, and the present low-water depth is reported to be 23½ feet, with a width between 22-foot contours of 70 feet. There was conveyed with the canal a lumber basin and a turning basin, both located at the Port Arthur terminal, and these also are to be maintained at government expense.

The commercial growth of this locality since the result of the jetty work made it possible for freighters of fair draft to enter the harbor has been very marked. The commerce has increased from about 300,000 tons in 1899, valued at about $3,000,000, to about 1,800,000 tons in 1907, 1908, and 1909, valued at about $23,000,000. That full advantage has been taken of the facilities offered is evidenced by the fact that vessels having a draft in excess of the low-water depth have been in constant use, and many of them have gone aground in the effort to get through with a full cargo.

The history of the development at this port indicates that if better facilities were given, advantage would at once be taken of them. To what extent additional depth and width in the channel and in the basins may be justified is a question which in the opinion of the Board is largely dependent upon the cost of the work involved. It seems clear that the jetties at least should be repaired and the full project depth and width of the channel through the entrance and in the canal restored.

SACO RIVER, MAINE.

Report on a recent survey is printed in House Document No. 752, Sixty-first Congress, second session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., February 21, 1910.

Respectfully returned to the Chief of Engineers, U. S. Army.

The head of navigation on the Saco River is at the towns of Biddeford and Saco, about 5 miles above its mouth. The average tidal range is about 8.8 feet. The depth on the bar just beyond the jetties is 3½ to 4 feet, with deeper water in the river above. There is generally available in the river a depth of 6 feet, except at two places where the depth is about 5 feet. The improvements heretofore made are in fair condition except the shore end of the north jetty, which is in need of repairs. The population of Biddeford and Saco is about 25,000. The volume of trade for 1909 is estimated at $18,000,000. The commerce handled by rail in 1909 is stated to have been 194,990 tons, and by water 50,746 tons, the latter being principally coal. This was handled in barges and schooners, of which 68 drew 9¼ to 13½ feet, and 26 drew 12 to 13.7 feet. The full loaded draft of the latter, however, is about 14 feet.

It appears that the needs of navigation would be fairly well met by a channel which would accommodate at ordinary tides the larger class of vessels mentioned above. The district officer believes that a channel 7 feet in depth at mean low water will serve for this purpose. He presents a comprehensive plan of improvement involving repairs to existing works, dredging at certain localities, and the extension of both the north and south jetties. The estimated cost of this work is $218,000. Included in this is an item of $150,000 for the extension of the north jetty. While this extension would materially aid in securing the permanency of the entrance channel, the district officer believes that a reasonably permanent channel may be secured by the extension of the south jetty aided by dredging, and on account of the large cost of the north jetty he omits this from the plan recommended for present adoption. The project proposed involves dredging, some ledge excavation, repairs to existing jetties, and the extension of the south jetty, all as shown on accompanying map, at an estimated cost, including contingencies, of $55,000. The estimate for maintenance is $3,000 annually. The division engineer concurs with the district officer in believing the locality worthy of improvement to this extent.

The channel obtained by the work already done is not of sufficient depth or permanency to satisfy the actual needs of navigation, and no increase in commerce can be expected, nor will the full benefits of expenditures already made be realized until better facilities are made available. It is believed that the work proposed by the district officer is the least that will result in material benefit, and the Board is of opinion that its cost is justified by the probable resulting advantages to general commerce and navigation.

In view of the foregoing, the Board concurs in recommending the improvement proposed by the district officer, at an estimated cost of $55,000 and $3,000 annually for maintenance. If full advantage is taken of the increased depth and a healthy growth of commerce results, it may become advisable to extend the north jetty, but this is not recommended at present.

The district officer describes existing wharves and terminal facilities, and attention is respectfully invited to his remarks on this subject. In compliance with the provisions of section 13 of the act of March 3, 1909, the Board reports that there are no questions of water power or other subjects so related to the project proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures made in the interests of navigation.

For the Board:

W. C. LANGFITT,
Lieut. Col., Corps of Engineers,
Senior Member Present.

SAGINAW RIVER, MICHIGAN.

Report on a recent survey is printed in House Document No. 740, Sixty-first Congress, second session. Following is the letter of the Chief of Engineers:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, March 3, 1910.

SIR: I have the honor to submit herewith for transmission to Congress reports dated July 26, 1909, and January 14, 1910, with maps, by Lieut. Col. C. McD. Townsend, Corps of Engineers, on preliminary examination and survey, respectively, called for by the river and harbor act approved March 3, 1909, of Saginaw River, Michigan, with a view to securing a depth of 20 feet from Saginaw Bay to Tittabawassee River.

The existing project for improvement of this river adopted in 1882 provides for a channel 200 feet wide, 14 feet deep, from Saginaw Bay to and along the front of Bay City, thence 12 feet deep to the upper limits of the city of Saginaw. By the river and harbor act of August 5, 1886, the improvement of the west channel, with a view to securing a depth of 12 feet along West Bay City, was also added to the project. Under this project there has been secured a channel 200 feet wide, 14 feet deep, from the mouth of the river to Portsmouth Bridge, in Bay City; thence 12 feet deep to the Michigan Central Railroad bridge, in Saginaw, and thence to Center Street Bridge, 150 feet wide and 12 feet deep. The portion from the Michigan Central Railroad bridge to the head of the river has not as yet been completed to the project depth and width.

The district officer submits plan for improvement to provide a channel 200 feet wide, 18 feet deep, in the bay and 16 feet deep in the river up to its junction with the Tittabawassee, at an estimated cost of $686,000, with $20,000 annually for maintenance, and one contemplating a channel 200 feet wide and 20 feet deep from the bay to the junction of the rivers, at an estimated cost of $1,541,000, with $25,000 annually for maintenance. These plans involve the dredging of silt, sand, clay, and hardpan and depositing the material on the banks in the vicinity of the excavation. In the opinion of the district officer the depth of 12 feet provided under the present project is insufficient for the class of vessels now in use on the Great Lakes, and he states that either the river should be deepened or the existing project for its improvement abandoned. While he deems present commerce insufficient to justify the cost of further improvement, he believes that a depth of 16 feet will cause such a marked increase in commerce as to justify the improvement to that depth, and he therefore recommends that the channel be deepened to 16 feet in the river and 18 feet in the bay, as outlined above. The division engineer is of opinion that neither present nor reasonably prospective commerce would justify the cost of the improvement proposed.

These reports have had consideration by the Board of Engineers for Rivers and Harbors, which has held a public hearing in this city, and the Board is of opinion that it is inadvisable to continue expenditures under the present project, as resulting benefits are incommensurate with the cost. It believes, however, that if full advantage is taken of a 16-foot depth, as local interests believe will be the case, its cost will not be unreasonable, and it recommends this project for adoption.

I concur with the district officer and the Board of Engineers for Rivers and Harbors in the opinion that this locality is worthy of improvement to the extent of providing a channel 16 feet deep in the river and 18 feet deep in the bay, at an estimated cost of $686,000, with $20,000 annually for maintenance.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

The commerce benefited by the improvement has decreased in recent years, and amounted to 264,648 tons in 1908, of which about 79,000 tons were received and shipped at Saginaw. The principal articles received were lumber, logs, coal, and general merchandise. The principal articles shipped were cement, salt, cedar ties, scrap iron, and general merchandise. Formerly the great item of export was lumber, but with the clearing of the forests of Michigan the principal items of import have become timber products. Both Saginaw and Bay City are rapidly developing from lumber towns into large manufacturing centers, and desire to obtain the crude products for manufacture by water transportation. Coal is the most important prospective natural resource. The coal is bituminous, of low grade, and found in thin seams. The coal measures cover an area of more than 10,000 square miles, and the principal

production has heretofore been in the counties of Saginaw and Bay, which in 1907 mined over 2,000,000 tons. The coal-mining industry is rapidly increasing. The output at present is shipped by rail to near-by towns, but if the channel in the Saginaw River should be sufficiently improved much might be transported by river. Other items which can be produced in the Saginaw Valley in large quantities, and which would naturally seek water transportation, are salt and cement.

SHOOTERS ISLAND CHANNEL, NEWARK BAY, NEW YORK AND NEW JERSEY.

The following is from House Document No. 337, Fifty-ninth Congress, second session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., December 12, 1906.

Respectfully returned to the Chief of Engineers, U. S. Army.

The Board of Engineers for Rivers and Harbors has had under consideration the within report of the district officer on a survey of a channel from the Kill van Kull north of Shooters Island to the existing channel near to Corner Stake light, including the reef at Bergen Point light, with a view to obtaining a depth of 16 feet, made in extension of a preliminary examination for the purpose of formulating an estimate of cost of the work deemed necessary at this locality.

In its report reviewing that of the district officer on the preliminary examination above referred to, the Board discussed the commercial necessity for the proposed improvement and expressed the opinion "that the channel south of Shooters Island is inadequate for existing commerce and should either be enlarged or a second channel constructed north of the island." Further study developed the fact that sufficient widening of the south channel to meet the present and future necessities of navigation is impracticable on account of the great value of abutting property on Staten Island, precluding the possibility of a sufficient setting back of the harbor lines. The additional facilities required can therefore best be obtained to the north of Shooters Island, and the district officer submits a plan, at a total cost of $280,115, covering the work required to provide a channel from Kill van Kull to the existing channel near Corner Stake light 300 feet wide and 16 feet deep at mean low water, together with the removal of part of the reef at Bergen Point and of the middle-grounds in the locality of Corner Stake and Bergen Point lights. The cost of maintenance is estimated at $5,000 annually.

Having in mind the enormous commerce utilizing the water route through Kill van Kull and Arthur Kill, and the obvious present and future necessity for greater facilities than can be afforded by the narrow channel between Shooters Island and Staten Island, the Board concurs in the opinion of the district officer that it is advisable for the United States to undertake the further improvement of this locality, and it recommends the adoption of the project outlined within as an extension of the existing project for the improvement of Arthur Kill, or Staten Island Sound, from Kill van Kull to Raritan Bay.

For the Board:

R. L. HOXIE,
Lieut. Col., Corps of Engineers,
Senior Member Present.

The Chief of Engineers concur in the above.

ST. CLAIR RIVER, MICHIGAN.

The following report of the Board of Engineers on a recent survey is concurred in by the Chief of Engineers and printed in House Document No. 453, Sixtieth Congress, first session.

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., December 2, 1907.

Respectfully returned to the Chief of Engineers, U. S. Army.

In the within report the district officer submits plans for constructing a channel 20 feet deep connecting the North and South channels of St. Clair River between Herson Island and Russell Island, in the vicinity of Algonac, Mich. The cost of a channel 100 feet wide is estimated at $31,633, one 200 feet wide at $55,596, and one 300 feet

wide at $79,693. While either of the smaller channels proposed would probably serve the needs of the local passenger business to and from Algonac, in which one line of steamers is principally interested, the district officer believes that a channel 300 feet wide will be of some benefit to through commerce on the St. Clair River, and for this reason he recommends its adoption.

Under existing conditions vessels bound to or from Algonac must make a rather difficult turn at the head of Russell Island, directly on the main line of through traffic, where the channel narrows to less than 1,000 feet. The proposed cut would provide a route affording access to Algonac for both upstream and downstream traffic, obviating the necessity for making the turn at the head of Russell Island, which is not only dangerous for vessels bound to or from Algonac, but likewise involves equal risk of collision to vessels engaged in through commerce. Viewed as an improvement for the sole benefit of the local traffic at Algonac, the advisability of the work would appear doubtful, but the report of the district officer makes it clear that the provision of a channel suitable to the needs of general commerce will be a work fully justified by the measure of safety it will afford at this point to the constantly growing and often congested through navigation of the St. Clair River.

In view of the above, the Board recommends approval of the project contained within for excavating between Russell Island and Herson Island a channel 300 feet wide and 20 feet deep at a cost of approximately $100,000, including 10 per cent for contingencies and $10,000 to cover the cost of land needed for the necessary right of way.

For the Board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

Mr. B. W. Parker, general manager of the White Star Line of steamers, in letter of March 11, 1907, writes me of their business for the season of 1906, as follows:

"Our steamer *City of Toledo* made 217 landings at Algonac and carried to and by the town 90,237 people, the steamer *Greyhound* made 16 landings and carried 15,911 people, steamer *Tashmoo* made 182 landings and carried 137,421 people, and the steamer *Owana* made 244 landings and carried 30,658 people; a total of 659 landings at the port of Algonac with our four steamers and carried passengers to and by the town to a total of 274,227 people."

The new proposed channel would mean a saving on the 659 trips of nearly 750 miles during the season, and would avoid the point where accidents are so liable to occur, thus greatly diminishing the chances of a collision with one of these passenger steamers with its attendant loss of many lives.

ST. CROIX RIVER, MAINE.

Report on a recent survey is printed in House Document No. 748, Sixty-first Congress, second session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., February 15, 1910.

Respectfully returned to the Chief of Engineers, U. S. Army.

The district officer presents herein a comprehensive analysis of physical, commercial, and tidal conditions, and concludes that the needs of navigation would be satisfactorily met by a channel 9 feet deep and 100 feet wide from the upper steamboat wharf at Calais to the public landing at St. Stephen; 9 feet deep and 150 feet wide thence to the lower steamboat wharf in Calais; thence 12 feet deep and 200 feet wide to the mouth of the river.

The estimate for this work is $270,000 for construction and $2,000 for annual maintenance. There is included in the estimate $32,580 for a training dike which is not recommended for immediate construction. If this item be omitted from the estimate for the present, the cost of the improvement should be, in round figures, $234,000. It is believed that the proposed channel is partially in Canadian waters and the district officer is of opinion that the Canadian government should cooperate in the work, but he believes the improvement is of sufficient importance to American commerce to justify its cost by the American Government alone, provided that assurance be given by local interests that the deposit of sawdust or other obstructive mill waste in the river is discontinued. The division engineer concurs in the recommendation of the local officer, but invites attention to the necessity of a turning basin at the head of the proposed channel.

The water-borne commerce of St. Croix River is reported as amounting to about 200,000 tons, of which 80 per cent is accredited to the American shore and 20 per cent to the Canadian. Vessels handling this commerce are greatly inconvenienced on account of insufficient depth and must take advantage of the tides. A channel which would entirely obviate the necessity of dependence on the tides would have to be about 20 feet in depth at low water. The cost of such a channel is obviously prohibitive. It appears that a channel of the dimensions outlined by the district officer, 9 and 12 feet in depth, will meet all reasonable demands of commerce, and the Board believes that the cost as estimated by him is not unreasonable when compared with probable resulting benefits.

While it appears that the benefits to American commerce will be sufficient to warrant the expenditure involved, the Board believes that an effort should be made to secure the cooperation of the Canadian government to the extent of 20 per cent of the total cost. In the opinion of the Board no work should be undertaken until the injury of the river by the dumping into it of sawdust and other similar refuse has been permanently stopped.

Subject to the above, the Board recommends the adoption of the project proposed by the district officer at an estimated cost of $234,000. The construction of the dike is not included in the estimate, as it is believed that its construction should not be undertaken until the channel has been dredged and the necessity for the dike is fully demonstrated. The widening of the channel in the vicinity of the public wharf at St. Stephen will serve for a turning basin for the present. This location is but 1,700 feet below the head of the improvement, and boats that go above this widening can be dropped down for turning.

The district officer describes existing wharves and terminal facilities, and attention is respectfully invited to his remarks on this subject. In compliance with the provisions of section 13 of the act of March 3, 1909, the Board reports that there are no questions of water power or other subjects so related to the project proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures made in the interests of navigation.

ST. LUCIA (LUCIE) INLET, FLORIDA.

Report on a recent survey is printed in House Document No. 1312, Sixtieth Congress, second session. Following is the letter of the Chief of Engineers submitting the same:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, January 7, 1909.

SIR: I have the honor to submit herewith for transmission to Congress reports of July 19, 1907, by Maj. Francis R. Shunk, Corps of Engineers, and October 1, 1908, with map, by Capt. George R. Spalding, Corps of Engineers, on preliminary examination and survey, respectively, of St. Lucia (Lucie) Inlet, Florida, as provided for by the river and harbor act approved March 2, 1907.

As a result of the preliminary examination Major Shunk expressed the opinion, based upon the facts and reasons given, that this locality is not worthy of improvement by the United States; but upon representations made before the Board of Engineers for Rivers and Harbors in the course of its review of the subject it was made to appear that additional information was essential to a proper determination of the question, and a survey was ordered as authorized by law.

In his survey report of October 1, 1908, Captain Spalding presents alternative plans for improvement designed to secure a channel at St. Lucie Inlet leading from the ocean to an interior basin, the channel and basin to have an available depth of 18 feet at mean low water and the entrance to be protected by a single jetty on the north side. In his opinion the locality is worthy of improvement and he recommends for adoption the plan in which the basin is located in the mouth of St. Lucie River in rear of Sewalls Point; the cost of the work is estimated at $1,460,000, with $5,000 annually for maintenance. It is noted, however, that the local officer states that it is not improbable that a similar jetty will eventually be needed on the south side of the entrance to protect the channel from sand movement from that direction.

In forwarding this report by his indorsement of October 5, 1908 (copy herewith), the division engineer, Col. Dan C. Kingman, Corps of Engineers, agrees with the district officer in his opinion that this locality is worthy of improvement to the extent and in the manner indicated, but differs with him as to the method and cost of effecting such improvement. The division engineer recommends that two jetties be provided for and that the excavation be done with a dredge owned and operated by the United

States. In his opinion the whole improvement can be carried out for considerably less than a million dollars.

In connection with its final review of the subject the Board of Engineers for Rivers and Harbors held a public hearing and made an inspection of the locality on December 11, 1908. In its report of December 22, 1908 (herewith), the Board agrees with the division engineer in believing that two jetties will be necessary, but does not concur in the estimate of cost. Certain changes in the plan are proposed, and it is suggested that still other details be left for further study; the estimate is placed at not to exceed $1,400,000. In conclusion the Board expresses the opinion that the locality is worthy of improvement, but for the reasons given suggests the propriety of requiring the local interests to contribute a share of the expense of the necessary work.

The proposed improvement at this locality is intended to serve two purposes, first, to create a harbor where it will be possible for seagoing vessels of moderate draft to enter and anchor, or lie at wharves, so as to afford an outlet for the commerce tributary to Indian River and the connecting inland waterways, and, second, to provide a harbor of refuge for an exposed coast where there are at present no ports for vessels drawing more than 12 feet between Jacksonville and Key West, a distance of 600 miles, and where none is contemplated except at Miami. It also appears from the reports submitted that there is in contemplation by private parties the construction of a canal from St. Lucie River to Lake Okechobee and its tributary waters, which will afford an outlet on the east coast of Florida for a large amount of timber and other products from the interior, and this prospective traffic from the interior will add materially to the commerce to be affected by the improvement of the inlet.

Therefore, taking into consideration all the interests which will be served, in my opinion the improvement of St. Lucie Inlet and basin as proposed, at a cost not exceeding $1,400,000, is worthy of being undertaken by the United States in connection with the development of the inland waterways affected, and as a harbor of refuge, under the condition as to contribution by local interests recommended by the Board.

Further investigation will be necessary to definitely determine the details of the plans of improvement, but it is believed that this can be done whenever the work, if authorized, is actually undertaken, and that the total cost of the improvement will not exceed the limit above mentioned.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

In the report on the preliminary examination of St. Lucie Inlet, ordered by the act of March 2, 1907, information is given as to the commercial interests of the locality and as to the probable benefits which would result from the improvement of the inlet. It appears that the export commerce of this region which at the time of the former investigation was valued at $992,500, has now a valuation of $3,087,500 per annum, or an increase in value of $2,095,000, which would indicate that, so far as commercial considerations are concerned, conditions are somewhat more favorable than at the time of the former examination. No commercial use is made of St. Lucie Inlet, however, at the present time.

The following is from Senate Document No. 423, Sixty-first Congress, second session:

WAR DEPARTMENT,
BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., March 7, 1910.

SIR: 1. By your reference the Board has had before it the following resolution of the Committee on Commerce of the Senate:

"*Resolved by the Committee on Commerce of the Senate,* That the Board of Engineers for Rivers and Harbors be requested to prepare and submit a supplemental report upon the project set forth in House Document Numbered thirteen hundred and twelve, Sixtieth Congress, second session, presenting an estimate of cost of a modified project for a depth of twelve feet from the ocean to a point just inside St. Lucie Inlet, with its views thereon."

2. Complying with instructions from the Chief of Engineers, U. S. Army, the district officer has submitted by telegram an estimate of cost for constructing the 12-foot channel specified in the resolution, as follows:

Dredging and rock excavation for channel 12 feet deep and 150 feet wide across St. Lucie Inlet to pocket near North Point	$150,000
Construction of one jetty	135,000
Total	285,000

3. The original report referred to in the resolution contemplated an entrance through St. Lucie Inlet 18 feet deep, to provide for coastwise vessels of a class suitable for the shipment of the commodities raised in the vicinity to New York and other distant markets, and for the transportation of large quantities of lumber, which it was stated would be brought from Lake Okechobee district if the improvement were made. This plan also had in view the utilization of the inner basin as a harbor of refuge, as indicated in the report.

4. The modified plan now proposed has in view such a channel as would accommodate light-draft vessels, with a view to utilizing a line of boats recently put on between Jacksonville and Miami. The depth contemplated would not be such as could be used by ordinary coastwise vessels, and it would not be suitable for the transportation of lumber; neither would it provide facilities suitable for a harbor of refuge for general navigation.

5. The act of March 3, 1909, provides for a survey for an intercoastal waterway to include the east coast of Florida, as follows:

"Survey for the construction of a continuous waterway, inland where practicable, from Beaufort, North Carolina, to the Cape Fear River, North Carolina; thence to Winyah Bay, South Carolina; thence to Saint Johns River, Florida; thence to Key West, Florida, for the purpose of ascertaining the cost of a channel with a maximum depth of twelve feet, or such lesser depths along any section or sections of the said waterway as may be found to be sufficient for commercial, naval, or military purposes. Such survey shall include an examination of all practicable routes, the preparation of plans and estimates of cost along the most available route, and a report upon the desirability of utilizing as a part of such waterway any existing public or private canal, or any part thereof, and the probable cost of acquiring the same."

6. The report of this survey has not yet been made. Should this survey result in the adoption of a project for an inland waterway along the east coast of Florida, the same purpose would be served as by the 12-foot channel into St. Lucie Inlet now desired. The board therefore deems it inadvisable for the United States to undertake the construction of such a channel at this time.

For the Board:

Very respectfully,

WM. T. ROSSELL,
Colonel, Corps of Engineers,
Senior Member of the Board.

The CHIEF OF ENGINEERS, U. S. ARMY,
Washington, D. C.

THE NARROWS, SANTA ROSA SOUND, FLORIDA.

Following is the report of the Board of Engineers, printed in House Document No. 565, Sixty-first Congress, second session. The Chief of Engineers concurs.

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., December 27, 1909.

Respectfully returned to the Chief of Engineers, U. S. Army.

The district officer estimates that a channel 6 feet in depth through the narrows in Santa Rosa Sound can be obtained by dredging, at an estimated cost of $24,000. No estimate for maintenance is given, but an examination of the coast chart indicates that this item of expense would probably be quite small.

This water route forms a connection between Pensacola Bay and Choctawhatchee Bay, through which there is considerable traffic. A channel 6 feet in depth has been provided into Choctawhatchee River, and a similar depth through the narrows would obviously be of material value to the commerce of the locality.

In the opinion of the Board the cost of the work involved is reasonable when compared with probable resulting benefits, and therefore it concurs with the district officer and the division engineer in recommending the improvement as worthy of being undertaken by the General Government at the estimated cost of $24,000.

In compliance with the provisions of section 13 of the act of March 3, 1909, the Board reports that there are no questions of terminal facilities, water power, or other subjects so related to the project proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures made in the interest of navigation.

For the Board:

W. E. CRAIGHILL,
Major, Corps of Engineers,
Senior Member Present.

Following is the report on preliminary examination:

UNITED STATES ENGINEER OFFICE,
Montgomery, Ala., November 12, 1909.

SIR: I have the honor to submit the following report upon preliminary examination of the narrows, Santa Rosa Sound, Florida, for a channel of 6 feet, as provided for in river and harbor act approved March 3, 1909:

Santa Rosa Sound connects Choctawhatchee Bay with Pensacola Bay. Its general condition is shown on the Coast and Geodetic chart, the general depth being over 6 feet except in the narrows.

The commerce that passes through this sound is composed of the commerce on Choctawhatchee River and the commerce originating on Choctawhatchee Bay. The commerce reported on Choctawhatchee River for the last year was valued at $2,211,651.

The channel at the mouth of Choctawhatchee River has been dredged to a depth of 6 feet and a bulkhead constructed to maintain this depth. The depth on Choctawatchee River decreases as you proceed upstream, being 3½ feet to the mouth of the Holmes River and 2½ feet to Geneva.

The amount of commerce originating on the bay is estimated at 42,600,000 feet of lumber, 14,000 barrels of turpentine, and 49,000 barrels of rosin, amounting in value to over $1,000,000. The depth of water at the narrows limits the class of vessels handling this commerce.

This locality is, in my opinion, worthy of improvement by the General Government to secure a channel of 6 feet. No survey will be necessary. The conditions shown on the Coast and Geodetic chart have been checked by soundings at shallow places and are now practically the same as they were when this chart was made.

Very respectfully,

H. B. FERGUSON,
Captain, Corps of Engineers.

SIUSLAW RIVER, OREGON.

Following is the letter of the Chief of Engineers submitting report on a recent survey, printed in House Document No. 648, Sixty-first Congress, second session:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, February 2, 1910.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated July 23, 1909, and January 7, 1910, with map, by Maj. J. F. McIndoe, Corps of Engineers, on preliminary examination and survey, respectively, called for by the river and harbor act approved March 3, 1909, of Siuslaw River, Oregon, at the mouth.

There has been constructed by the General Government at this locality a jetty 4,090 feet long on the north side of the entrance, with a view to securing a depth of 8 feet at low tide, the last active operations being in December, 1900. The river and harbor act of March 3, 1905, contained a provision for the discontinuance of the improvement.

The district officer expresses the opinion, which is concurred in by the division engineer and the Board of Engineers for Rivers and Harbors, that further improvement of this stream is not worthy of being undertaken if the entire cost is to be borne by the United States.

In view of the fact, however, that the port of Siuslaw stands ready to cooperate in the improvement to the extent of $260,000, the district officer presents a plan for further improvement by extending the existing high-tide north jetty beginning at the point A on the map, westerly along the edge of the north spit and terminating at C, and by constructing a south jetty of similar height beginning at M and terminating at N, at which point it is distant 750 feet from the north jetty, with a short spur at the shore end terminating at E, all at an estimated cost of $426,000, and $5,000 annually during construction for maintenance and repairs. He recommends this project for adoption, conditioned, however, on local cooperation.

These reports have been referred to the Board of Engineers for Rivers and Harbors for consideration, and the Board recommends the adoption of this project provided the port of Siuslaw will supply one-half the cost of construction and maintenance during construction, which half shall be placed to the credit of the engineer officer in charge of the work in such sums and at such times as will enable equal amounts to be expended from the two funds as the work progresses; and provided further, that the amount

to be furnished by the port of Siuslaw may be reduced by such amounts as said port may have expended in such construction of the south jetty as can be utilized by the engineer officer in charge of the work in the execution of the plans adopted.

I concur in the recommendation of the Board of Engineers for Rivers and Harbors.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

The port of Siuslaw is incorporated with power to carry on certain work of river and harbor improvement and to contract with the Government of the United States to do any and all or any part of making or maintaining such a depth of water in such bay, etc., as said Government of the United States may from time to time make or maintain.

SMITHS CREEK, NORTH CAROLINA.

Report on a recent survey is printed in House Document No. 774, Sixty-first Congress, second session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., March 7, 1910.

Respectfully returned to the Chief of Engineers, U. S. Army.

The district officer submits within a plan and estimate for the improvement of Smiths Creek in the vicinity of the town of Oriental. It is proposed to dredge to a depth of 10 feet at mean low water certain areas in the channel of approach and to dredge an anchorage area and turning basin adjoining the business portion of the town. To protect this area from high seas it is proposed to build a bulkhead or breakwater consisting of two rows of sheet piling 300 feet apart, inclosing an area of about 7.6 acres, which is to be filled with material dredged from the harbor. The estimated cost of the improvement is $23,750, including the cost of the bulkhead, which is placed at $7,500. The estimate for maintenance is $1,000 annually. The district officer recommends the improvement, its cost to be borne by the United States, provided the town of Oriental convey, free of cost to the Government, title to the site to be reclaimed, so that said area when built up can be disposed of as part return for the cost of the improvement. The views of the division engineer appear to be in accord with those of the district officer.

In addition to the information furnished by the district officer, the Board has received a statement covering the commerce of the locality, prepared by interested persons, and on February 28, 1910, it listened to oral arguments in favor of the improvement, by Hon. F. M. Simmons, United States Senator; Hon. C. R. Thomas, Member of Congress, and a committee of citizens from the locality.

There is evidence that Oriental is developing rapidly, and that the improvement sought would be of value to general commerce and navigation and of particular value to the community centered about the immediate locality. It appears from statements made to the Board that real estate values have greatly enhanced in Oriental in the recent past. The proposed improvement, if carried out, should be an important factor in promoting a still further development and in adding greatly to the value of adjacent property. Except as a place of deposit for the material to be dredged from the basin, the area to be built up is not required by the United States, and the Board does not favor the Government's taking possession of this area with a view to its disposition by sale or otherwise. This desirable property should, however, be of great value to local interests, and in view of this and the further fact that the nature of the improvement is to some extent local, it seems clear that those who are to derive substantial benefit should bear a fair share of the expense of the work. The Board believes this share should be the cost of the bulkhead necessary to retain the excavation and the conveyance of the right of deposit of material behind the bulkheads.

Under these conditions the Board recommends the improvement proposed by the district officer, at a total cost of $23,750, of which sum the locality shall furnish $7,500.

The district officer describes existing wharves and terminal facilities, and attention is respectfully invited to his remarks on this subject.

In compliance with the provisions of section 13 of the act of March 3, 1909, the Board reports that there are no questions of water power or other subjects so related to the project proposed that they may be coordinated therewith to lessen the cost and

compensate the Government for expenditures made in the interests of navigation, except the construction of the bulkheads referred to above.

For the Board:

WM. T. ROSSELL,
Colonel, Corps of Engineers,
Senior Member of the Board.

In 1908 the commerce on this stream aggregated 72,915 tons, valued at $789,551. No statistics are available for 1909, but there is no reason to believe that it has decreased in tonnage or value. The prospects for a great increase on the opening of the inland waterway are very good.

SWIFT CREEK, NORTH CAROLINA.

Report on a recent survey is printed in House Document No. 360, Sixty-first Congress, second session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., November 1, 1909.

Respectfully returned to the Chief of Engineers, U. S. Army.

The within report contains an estimate of cost amounting to $1,600 for original work improvement, and not exceeding $500 thereafter for annual maintenance, to afford better navigation from the mouth of Swift Creek to Vanceboro, a distance of about 14 miles, by the removal of snags, logs, and overhanging trees from the upper 8 miles of this stretch, the lower 6 miles being in statisfactory condition. The report also contains an estimate of $1,000 for straightening the channel by cutting off sharp points, but while the district officer believes that the removal of obstructions at the cost stated is worthy to be undertaken by the General Government, he is of opinion that the suggested straightening is not necessary. The division engineer concurs in recommending the improvement to the extent favored by the district officer.

Based upon the information concerning the commerce of this stream contained in the accompanying report on preliminary examination, the Board concurs in the opinion that the work of removing obstructions at a cost of $1,600 and maintaining the work at an estimated cost of $500 annually is warranted by the probable benefits such work will confer, and it therefore recommends approval of the project outlined by the district officer.

In compliance with the provisions of section 13 of the act of March 3, 1909, the Board reports that there are no questions of terminal facilities, waterpower, or other subjects so related to the project proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures made in the interests of navigation.

For the Board:

JOHN G. .D KNIGHT,
Colonel, Corps of Engineers,
Senior Member of the Board.

There are two Swift Creeks in North Carolina—one a tributary of the Tar River, above Tarboro, which was made the subject of an unfavorable report in 1889; and the other a tributary of the Neuse River, about 8 miles above Newbern.

The latter stream is understood to be the one intended by Congress in the act above cited and is the subject of this report. No examination of this stream has been made heretofore.

This stream rises in Pitt County and flows in a southeast direction almost parallel to Contentnia Creek and Neuse River into Craven County, to a point about 8 miles below Vanceboro, when it turns and flows southwest for about 5 miles, emptying into Neuse River about 8 miles above Newbern.

The immediate banks of the stream are low and swampy, while a line of low bluffs is found 200 to 300 yards back on each side. These are occasionally found to approach the stream, especially at abrupt bends, and form the principal landings. The lower portion of the stream below Vanceboro, the head of navigation, is deep and sluggish, though quite tortuous in several places. The depth of water is nowhere less than can be brought up Neuse River to the mouth of the creek, viz, 4 feet at low water.

The stream, however, is so badly obstructed by sunken logs, trees, and snags, and overhanging trees as to render navigation exceedingly difficult and dangerous. Also, the tortuous channel with abrupt bends in several localities renders navigation doubly difficult when there is a slight rise from floods, which give rise to considerable currents.

The commerce to be benefited is mostly of a local character, amounting to nearly 25,000 tons annually, valued at about $300,000.

TACOMA HARBOR, PUYALLUP WATERWAY.

The following is printed in House Document No. 418, Sixty-first Congress, second session:

WAR DEPARTMENT,
BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., March 7, 1910.

SIR: 1. By reference from the Chief of Engineers, U. S. Army, the Board has had under consideration the following resolution:

"*Resolved by the Committee on Commerce of the Senate*, That the Board of Engineers for Rivers and Harbors, in view of recent floods, be, and it is hereby, requested and directed to review the project now under way for the improvement of the Puyallup waterway in the harbor of Tacoma, Washington, and to suggest such action as may be deemed desirable by Congress."

2. The existing project for improvement of Puyallup waterway, adopted by the act of March 3, 1905, contemplates a channel 500 feet wide and 28 feet deep, for a distance of 3,650 feet from the mouth of Puyallup River, at an estimated cost of $240,000. This work was undertaken under conditions requiring riparian owners to provide suitable places of deposit for dredged material and to construct the necessary bulkheads, in view of the substantial benefits they would derive from the reclamation of the adjacent areas and upon the further condition that the city of Tacoma assume the maintenance of the waterway.

3. As a result of a flood occurring in November and December, 1906, subsequent to the adoption of this project, the White River was turned bodily into the Puyallup River at a point near Sumner. The White River being considerably the larger of the two streams, the Puyallup was thus required to carry more than double its former normal flow; and as both rivers are heavy silt carriers the effect of this change was highly detrimental to the work in Puyallup waterway. In a report on the subject published in House Document No. 1107, Sixtieth Congress, second session, the district officer stated that he seriously questioned the possibility of maintaining the waterway, except at great expense, if the river continues to empty into it.

4. In November, 1909, when more than one-half of the work in Puyallup waterway had been completed, several violent freshets occurred, as a result of which large quantities of material were brought down and deposited within the improved area, practically obliterating the work done by the United States. A series of soundings, taken December 1, 1909, showed that the deterioration from natural causes exceeded 1,000,000 cubic yards. Doubtless a certain amount of fill has been taking place ever since the work was begun, but the great bulk of it occurred during the month of November, 1909. These circumstances, and the possibility of their recurrence, have thrown serious doubt upon the practicability of completing the project, while it is certain that the cost of maintenance would be very great.

5. By the committee resolution quoted above, the Board is required "to review the project now under way for the improvement of Puyallup waterway in the harbor of Tacoma, Washington, and to suggest such action as may be deemed desirable by Congress." The questions involved in the present case are physical rather than commercial. When the existing project for improvement of Puyallup waterway was recommended, conditions were not so unfavorable as at present to its economical completion. Under the existing conditions, as above described, the cost of maintenance would be so excessive that it does not seem probable that the city of Tacoma would be able to carry out its agreement to maintain this project. It is certain that the channel would be seriously impaired by every freshet, as the dredged channel, of easy slope, acts as a catch basin for the vast quantities of material eroded and brought down by the rapid currents above. The same causes would operate to prevent the successful and economical completion of the initial improvement by the United States.

6. In view of the facts given above, the Board believes that it is not advisable for the General Government to further prosecute the project for improvement of Puyallup waterway, and it recommends that the existing contract for work at the locality be terminated in such manner as in the judgment of the Chief of Engineers will best protect the interests of the United States.

7. At the time of the joining of the White River with the Puyallup local interests had under consideration the question of diverting the Puyallup by a separate outlet to the sound. If such a diversion were executed by local interests, it would solve the problem of maintaining the waterway at the mouth, which would be thus relieved from the deteriorating influences which now render successful improvement impracticable at any reasonable cost.

8. In view of the facts given above the Board is of opinion that under existing conditions there are no questions of terminal facilities, water power, or other related subjects which could be so coordinated with the project for improvement of Puyallup waterway as to render further work on this project advisable in the interests of commerce.

For the Board:

Very respectfully,

WM. T. ROSSELL,
Colonel, Corps of Engineers,
Senior Member of the Board.

WARROAD HARBOR, MINNESOTA.

Report on a recent survey is printed in House Document No. 703, Sixty-first Congress, second session. Following is the report of the Board of Engineers, in which the Chief of Engineers concurs:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., February 15, 1910.

Respectfully returned to the Chief of Engineers, U. S. Army.

As stated in the Board's indorsement of December 28, 1909, reviewing the report of the district officer on preliminary examination, the work desired at Warroad Harbor is the maintenance of channel depths and the enlargement of the basin at the upper end of the dredged channel. This basin is used as an anchorage, and it is of insufficient size to accommodate the boats which use it if several of them happen to be in the basin at the same time. Warroad is the only harbor of refuge in this part of the lake, and in time of storm available facilities are inadequate for all the vessels that seek its protection.

In the within report the district officer estimates that to enlarge the basin to 900 feet by 500 feet, which are believed to be adequate dimensions, will cost $5,700, and that on account of improved conditions since the completion of the jetty protecting the entrance, the harbor can be maintained by an expenditure of $2,000 annually.

Having in mind the substantial growth in the commerce of this locality since its improvement was inaugurated by the General Government in 1902, the Board believes that it is advisable for the United States to undertake the enlargement of the basin to the dimensions specified above, at an estimated cost of $5,700, and to expend the sum of $2,000 annually for maintenance of the harbor.

The district officer describes existing wharves and terminal facilities, and attention is respectfully invited to his remarks on this subject. In compliance with the provisions of section 13 of the act of March 3, 1909, the Board reports that there are no questions of water power or other subjects so related to the project proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures made in the interests of navigation.

For the Board:

W. E. CRAIGHILL,
Lieut. Col., Corps of Engineers,
Senior Member Present.

Following is an extract from the report on preliminary examination:

Since the date of the last annual report a branch of the Great Northern Railway has been extended to Warroad. A line of the Canadian Northern Railway, from Winnipeg to Fort Frances and Port Arthur, with connections for Duluth, already passed through it. Since the advent of the new road the population and activities of the town have noticeably increased. One may satisfy himself by counting that the number of houses has increased by 33 per cent, and there is abundant evidence that the business of the place has grown in proportion.

The navigation season was not over at the time of the examination on November 1. The harbor had been used by 20 lake vessels, carrying an aggregate of about 5,000 tons of merchandise and about 7,000 passengers. The closing weeks, just before the lake freezes, are usually the busiest. Besides this traffic there were a number of rafts towed into the harbor for fence posts, firewood, etc., of which no record was kept. It is safe to say that the water-borne commerce of Warroad has doubled during the year.

WHITE LAKE AND PENTWATER HARBORS, MICHIGAN.

These harbors were formerly carried as separate works, but are now consolidated in consequence of a provision in the river and harbor act of June 13, 1902.

(*a*) *White Lake Harbor.*—When the present project was adopted, the natural outlet of White Lake, about 3,550 feet north of the present entrance, afforded a channel 5 feet deep and 125 feet wide between slab piers built by local enterprise.

The approved project provided for the abandonment of the old outlet and the creation of a new one, 12 feet deep and 200 feet wide between piers and revetments. This project was adopted in 1866, amended in 1873, 1884, and 1892, the present amended estimated cost being $353,550. The various amendments to the original project have not altered it materially, as they relate principally to the length of the proposed piers and revetments. The provision in the act approved March 2, 1907, that "the Secretary of War is authorized to dredge the channel at Pentwater to the depth of 16 feet and to dredge the channel at White Lake to sufficient depth to allow the free use of the government dredge *Gillespie*," may be said to have changed the project to one of 16-foot depth and 200 feet width between piers and revetments.

To June 30, 1909, there was expended upon the existing project the sum of $351,032.40, of which $207,862.44 was for construction and $143,169.96 for maintenance.

There have been no operations at the harbor during the fiscal year, and the expenditures have been for making the customary soundings and for contingencies and for dredging by the *Gillespie* in last fiscal year. An emergency contract for refilling parts of the piers with stone was entered into July 1, 1908, but no stone has as yet been delivered. It is probable that the stone will be received soon.

The proportion of the approved project completed to June 30, 1909, is about 91 per cent. The existing constructions consist of a north pier and revetment 1,715 feet long, and of a south pier and revetment 1,953 feet long, and the natural depth of channel between them is about 10 feet. Periodical dredging is necessary to secure and maintain a depth of 16 feet. The maximum draft that could be carried over the shoalest part of the channel at the end of the fiscal year was 13 feet.

In 1908 there were at this harbor 224 arrivals and departures, with 12,549 short tons of cargo, valued at $475,000, and entirely local in character. The local freight rates by vessel from White Lake to Chicago are about 14 per cent less than the corresponding rates by railroad.

The harbor is but 10.5 miles north of Muskegon.

After providing for the estimated cost of the stone to be delivered under the outstanding contract, and without use of the $67,000 allotted from the appropriation of March 3, 1909, for repairing the piers, the remaining balance of available funds will be sufficient to pay for the required dredging in 1909, for which bids will be invited early in July.

The conditions at White Lake Harbor were made the subject of a special investigation by the district officer, whose report was referred for review by the Board of Engineers for Rivers and Harbors. In the opinion of the Board this harbor is not worthy of further improvement by the General Government, and even the outlay necessary for maintenance and repairs would greatly exceed that warranted by existing and prospective commerce. Concurring in the views of the Board, and in compliance with section 7 of the river and harbor act of March 3, 1899, it is recommended that further appropriations for White Lake Harbor be discontinued.

However, pending action by Congress providing for the definite abandonment of the improvement, and since funds for maintenance have been specifically provided, it is believed that dredging and minor repairs to afford facilities for the existing commerce should be done, and it is proposed to reserve $10,000 for repairs and $6,000 for dredging in 1910 and 1911 from the allotment made available from the appropriation by the act of March 3, 1909.

The last published map of the locality is contained in the Annual Report of the Chief of Engineers for 1884, page 1982.

(*b*) *Pentwater Harbor.*—Before work was begun at this harbor by the United States there existed an irregular channel 4 feet deep and 75 feet wide between slab piers built by local enterprise.

The existing project, adopted in 1867 and amended in 1873, 1884, and 1892, provides for widening the old entrance to 150 feet and deepening it to 12 feet, the sides being protected by piers and revetments. Estimated cost was $327,713.40. The amendments to the original project relate merely to the length of the proposed piers and revetments and in no wise enlarge its original scope. The present project, by reason

of the provision in the act of March 2, 1907, contemplates a channel 16 feet deep and about 150 feet wide, protected by suitable piers and revetments.

To June 30, 1909, there was expended the sum of $312,533.32, of which $179,899.10 was for construction and $132,634.22 for maintenance. There have been no operations during the past fiscal year, and the expenditures were made for the customary soundings.

The proportion of the approved project completed to June 30, 1909, is about 85 per cent.

The result is a channel 140 to 153 feet wide, whose natural depth is from 9 to 10 feet, protected by a north pier and revetment 2,226 feet long and a south pier and revetment 1,847 feet long. Periodical dredging is necessary to secure the projected depth of 16 feet. The maximum draft which on June 30, 1909, could be carried over the shoalest point in the improved channel was 12.6 feet.

The lake commerce at this port for 1908 consisted of 1,354 arrivals and departures, with 2,431 short tons of cargo, valued at $340,000 and entirely of local character. The local freight rates by vessel to Chicago are about 20 per cent less than the corresponding rates by railroad.

The following table gives the vessel commerce of Pentwater Harbor since 1900:

Calendar year.	Freight received.	Freight shipped.	Total freight carried.	Increase or decrease over previous year.
	Tons.	*Tons.*	*Tons.*	
1900	13,288	16,465	29,753	.....
1901	1,000	5,070	6,070	−23,683
1902	(a)	(a)	(a)	(a)
1903	8,675	13,555	22,230	.....
1904	3,000	12,423	15,423	− 6,807
1905	1,128	1,712	2,840	−12,583
1906	2,175	11,238	13,413	+10,573
1907	875	1,657	2,532	−10,881
1908	1,051	1,359	2,410	− 122

a Not reported.

This table shows that during the calendar years 1906, 1907, and 1908 the total vessel freight movement was about 18,355 tons, and the records of this office show during the same years a total expenditure by the United States of $19,024, or $1.04 for each ton of vessel freight. The cost to the United States is evidently unjustifiably great.

The conditions at Pentwater Harbor were made the subject of a special investigation by the district officer, whose report was referred for review by the Board of Engineers for Rivers and Harbors. After considering the past, present, and prospective commerce of the locality, the sum expended on its improvement, and the necessary expense attending its future maintenance, the Board expressed the opinion that it is not desirable for the United States to make further expenditures for the improvement or maintenance of this harbor. Concurring in the views of the Board and in compliance with section 7 of the river and harbor act of March 3, 1899, it is recommended that further appropriations for Pentwater Harbor be discontinued.

Since, however, funds for maintenance have been specifically provided and pending action by Congress providing for the definite abandonment of the improvement, it is believed that dredging and minor repairs to afford facilities for the existing commerce should be done, and it is therefore proposed to reserve $10,000 for repairs and $6,000 for dredging in 1910 and 1911 from the allotment made available from the appropriation by the act of March 3, 1909.

The last published map of this locality is found in the Annual Report of the Chief of Engineers for 1884, page 1980.

CONSOLIDATED.

July 1, 1908, balance unexpended	$10,924.32
Proceeds of sale of government property	1,150.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	32,000.00
	44,074.32

June 30, 1909, amount expended during fiscal year, for maintenance of improvement	$1,118.74
July 1, 1909, balance unexpended	[a] 42,955.58
July 1, 1909, amount covered by uncompleted contracts	2,490.50
Amount (estimated) required for completion of existing project	48,120.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	[b] 4,000.00

WILLAMETTE RIVER—PURCHASE OF CANAL AND LOCKS.

The following letter bears on this item:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, March 22, 1910.

SIR: 1. Replying to your letter of the 21st instant, I have the honor to submit the following in reference to suggested provision for improving Willamette River, Oregon:

2. In accordance with the provision in the river and harbor act of March 30, 1899, the matter of acquisition of the canal and locks at Willamette Falls, Willamette River, Oregon, was investigated by a Board of Engineers, and its conclusions and recommendations on the subject are as follows:

"The Board can not recommend the acceptance of the offer of the Portland General Electric Company to sell the canal and locks to the United States for $1,200,000, as this price is considered excessive.

"In the opinion of the Board the public interests to be benefited and the commerce, present and prospective, of the Willamette River will not justify the United States in acquiring possession of the present canal and locks unless the total cost for construction, right of way, water rights, and land necessary, etc., including separation of the canal from the water-power intake, shall not exceed, approximately, $456,000.

"If satisfactory terms of transfer of the old canal and locks to the United States, including land necessary, water rights, etc., can not be obtained for this amount it is recommended that the construction of a new system of locks and canal be undertaken by the General Government practically as indicated in the plans submitted at an estimated cost of $456,000.

"To the extent stated above, viz, $456,000, the river at this point is considered worthy of improvement by the General Government.

"Before either the present locks are acquired or new ones built the exact legal rights of the United States to water for lockage purposes and incident thereto the right to control the waters to insure sufficient supply should be determined beyond question by the Department of Justice."

3. In accordance with the last paragraph of the recommendations of the Board as to the necessity for a determination of the legal rights of the United States in the premises, a second Board of Engineers was provided for in the act of June 13, 1902, which was directed to report also as to the effect upon manufacturing enterprises of the acquisition by the United States of the canal and locks at Willamette Falls, or construction of new canal and locks and their operation for the exclusive benefit of navigation. The conclusions of this Board and the opinion of the Department of Justice are given at length in House Document No. 99, Fifty-eighth Congress, third session, and are briefly that, provided certain changes are made in the structures, the acquisition of the present canal and locks at Willamette Falls or the construction of a new canal and lock by the United States and their operation for the exclusive benefit of navigation would not injure in a material manner the operations of the manufacturing enterprises now in operation or contemplated at the falls of Willamette River; and as to the legal situation, that the United States, if it should be deemed necessary, has the absolute right to the entire flow of waters of a navigable river, and it necessarily follows that "neither the Portland General Electric Company nor any other person, except the United States, except for commerce, has any valid and existing right to the full, free, and continued

[a] In addition to this amount, the sum of $69,000, made available by the river and harbor act of March 3, 1909, remains unallotted.

[b] Since the preparation of this estimate these harbors have been made the subject of a special investigation and report, as a result of which they are now regarded as unworthy of further improvement by the United States. Pending the further action by Congress in the premises, this estimate may be omitted.

use of the water of the Willamette River for use of manufacturing enterprises now located on their property."

4. No action has been taken by Congress in pursuance of these reports and recommendations.

5. A provision for further examination was inserted in the last river and harbor act. In the meantime, however, the State of Oregon has appropriated $300,000 for the purchase or construction of a canal and locks, contingent upon a like appropriation by the United States, and in default of action by Congress this lapses on January 1, 1912. Under the state act the first levy of $100,000 can not be made until the first of January following an appropriation by Congress, so that the state funds are not immediately available. Up to the present time no satisfactory offer for the sale of the existing canal and locks has been made by the owners, and it is not anticipated that in the absence of action to secure a site for a new lock and dam the investigation now in progress will secure any voluntary offer at a price materially less than that originally quoted, $1,200,000.

6. The advantages which may be expected to result from the enactment of the proposed provision are as follows:

(*a*) It will secure the state appropriation of $300,000, which may otherwise be repealed at the coming session of the state legislature, and insure the first levy on January 1 next.

(*b*) It will put the United States in position to treat with the owners of the present canal and lock on a different and more satisfactory basis, and if a reasonable offer is not secured which will enable the United States to purchase the existing canal and locks and construct the necessary diversion wall to separate the canal from the water-power intake at a total cost of $600,000, condemnation proceedings can be instituted on the east bank of the river and the cost of the right of way determined upon for new canal and locks.

7. The advisability and worthiness of the improvement of this locality is primarily a question of cost, and until the actual expense of securing the existing canal and locks or acquiring a suitable right of way for a separate canal and lock on the opposite side of the river is determined, no definite decision can be reached as to whether the United States should undertake the improvement; action at the present session of Congress will put this material question of cost in process of determination, and it is not seen how, in the absence of such determination, the results of the present investigation can be anything but a conditional recommendation based on cost of right of way or acquisition of the present canal and locks. Therefore, the sooner this question of cost can be determined, the sooner Congress will be in position to make a proper decision; and all the essential preliminaries to such determination are as fully settled now as they will ever be.

8. Should this provision become law and the cost of the old canal and locks and of the site of the new canal and lock both prove to be unreasonable, making the cost of the improvement exceed the $600,000 authorized, no further action would be taken until Congress has indicated its further wishes. Moreover, should the resort to legal process or the evident power and intentions of so doing lead to more reasonable propositions from the owners of the present canal and locks, the matter may be put in shape in the report now in preparation for definite action at the next session of Congress.

9. The provision is drawn to provide for necessary surveys, preliminary to condemnation, and to make the funds available for payment of condemnation award, should such award be acceptable to the United States.

Very respectfully,

J. B. CAVANAUGH,
Major, Corps of Engineers.

Hon. T. E. BURTON,
United States Senate.

The following report of the Board of Engineers is printed in Senate Document No. 416, Sixty-first Congress, second session:

WAR DEPARTMENT,
BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., March 1, 1910.

SIR: 1. The board has the honor to submit its report in response to the following resolution:

"*Resolved by the Commerce Committee of the United States Senate*, That the Board of Engineers for Rivers and Harbors be, and is hereby, requested as soon as possible to review the project for improving Saint Michael Canal, Alaska, and submit its recommendation as to what it deems advisable for the further prosecution thereof."

2. The project for the improvement of this waterway was adopted by the act of March 2, 1907. It contemplates dredging a channel 100 feet wide and 6 feet

deep at mean low water, including an extensive cut-off, all at an estimated cost of $248,000. The report on which the project is based is printed in House Document No. 389, Fifty-ninth Congress, second session. The accompanying report of the district officer gives a very clear description of the improvement to date and recommends a modification of the existing project.

3. It appears that it has been impracticable to secure bids for doing the work at anything like the original estimates, owing probably to the isolated location, and it is found that it will require a further expenditure of $327,650 to complete the project, including $18,000 for additional work deemed necessary to secure project dimensions at a locality where it was thought originally no work would be required. This amount, taken in connection with expenditures already made, represents a sum in excess of that deemed justifiable by the commerce involved.

4. In view of these facts, the district officer presents a modified project which will provide a reasonably good channel without the expensive cut-off. This is to be done by continuing the dredging from point "A" to station "11A," excavating where necessary between station "11A" and point "B," and at two sharp bends between station "11A" and station "28A," at an estimated cost of $143,000. He believes the interests of general commerce to be sufficient to warrant this expenditure, and in this view the division engineer concurs.

5. This is a case in which it appears necessary to make some further expenditures in order to realize the benefits of those already made. The improvement as it now stands would be of little value, but it can be made effective in the interests of navigation by the additional expenditures now proposed. While the channel now proposed would not be as convenient as the one by way of the cut-off, it will afford safe navigation by the sheltered route, and this is the real object of the improvement.

6. In view of the foregoing, the board recommends a modification of the existing project as proposed by the district officer and as outlined above, at an estimated cost of $143,000.

7. In compliance with the provisions of section 13 of the act of March 3, 1909, the board reports that there are no questions of terminal facilities, water power, or other subjects so related to the project proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures made in the interests of navigation.

For the board:

Very respectfully,

W. C. LANGFITT,
Lieut. Col., Corps of Engineers,
Senior Member Present.

The CHIEF OF ENGINEERS, U. S. ARMY,
Washington, D. C.

ST. JOHNS RIVER, FLORIDA, JACKSONVILLE TO THE OCEAN.

The following report of the Board of Engineers on a recent survey, in which the Chief of Engineers concurs, is printed in House Document No. 611, Sixty-first Congress, second session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., January 3, 1910.

Respectfully returned to the Chief of Engineers, U. S. Army.

The within is a comprehensive report of the district officer on a survey with plans and estimate of cost for securing a channel 30 feet in depth from Jacksonville to the ocean. It is proposed to follow generally the line of the present channel, which is the one obtained under the existing project for a depth of 24 feet. The width proposed is 300 feet in the straight reaches, increasing to as much as 600 feet in the bends and through the jetties. The principal work involved is dredging, rock removal, and constructing training walls and revetments. Practically all the work done up to the present time will be utilized in the plan now proposed for increasing the depth.

The estimated cost is as follows:

Dredging soft material	$1,290,000
Dredging rock and hard clay	604,000
Training walls	757,950
Engineering, superintendence, and contingencies	200,050
Total	2,852,000

The district officer estimates that the cost of maintenance will not exceed $60,000 per year, and that if that amount is expended annually for a period of five years after the completion of the 30-foot channel, no further maintenance will be required. He concludes his report with the opinion that the improvement is justified by present and immediately prospective commerce. The division engineer concurs generally in the plans presented and in the conclusions of the district officer as to the advisability of the improvement, suggesting only that the Mill Cove cut-off dam be undertaken tentatively.

Having some doubts as to the feasibility, from an engineering point of view, of creating a channel 30 feet in depth along the lines designed for a channel of much less depth, and of the practicability of such a channel, a committee of the board visited the locality, inspected the river throughout the reach under consideration, examined the plans on the ground, and consulted with practical mariners and business men regarding the practicability of the proposed channel and the possibilities of future commerce.

Those prominently connected with the handling of the largest vessels now using this port expressed entire confidence in the practicability of the channel as laid down by the district officer and in their ability to handle in such a channel vessels 450 to 550 feet in length and drawing 26 to 27 feet of water, the size of the vessels that would use the improved channel.

It appears that the foreign commerce of Jacksonville is of recent growth, and that the development of this class of commerce is the principal argument in favor of the improvement now desired; that vessels now engaged in this traffic can not load to their full draft, and consequently must top out their loads at other ports when going abroad and unload part of their cargo before coming into Jacksonville. This condition necessitates delay and a loss of from $1,000 to $2,500 on each vessel for making the additional port. Besides this loss there is an additional freight charge on the products so loaded, much of which is hauled by rail from the vicinity of Jacksonville to other ports. There seems to be a reasonable assurance that this class of commerce will increase in the future and that the disadvantages of existing conditions and the necessity of deeper water will become more apparent.

It appears that if the 30-foot project be adopted, expenditures made in its prosecution will result in almost immediate benefits, as the work can be so conducted that the most troublesome places will be taken up first and the increase in depth will be gradual throughout the reach and of benefit from the start.

Considering the very marked increase in commerce in recent years, its present healthy condition, the growth of Jacksonville, the development of the adjacent country, the rapid strides being made in the foreign trade, and the apparent discrepancy between the available channel depth and the draft of the vessels that handle this trade, the board is led to concur with the district officer and the division engineer in the opinion that St. Johns River from Jacksonville to the ocean is worthy of improvement to the extent of providing a channel 30 feet in depth and of suitable width. It appears that the project proposed by the district officer has been carefully prepared and that if liberal appropriations are made available it seems probable that it can be effectively carried out. The project should, however, have some elasticity and be subject to such modifications in details as the Chief of Engineers may deem advisable. While the question of maintenance is difficult of solution, the board believes that some expenditure will always be required for this purpose. This must be expected, however, in almost every work of importance.

The district officer has given consideration to the question of terminal transfer facilities at this locality, and attention is respectfully invited to his remarks on this subject in the report on preliminary examination and also in the within report. There are no questions of water power involved in the improvement under consideration, and in the opinion of the board there are no other subjects so related to the project herein recommended that they can be advantageously coordinated therewith in the interests of commerce and navigation.

For the board:

WM. T. ROSSELL,
Colonel, Corps of Engineers,
Senior Member of the Board.

GREEN RIVER, KENTUCKY.

The following is from House Document No. 377, Fifty-ninth Congress, first session:

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., January 3, 1906.

Respectfully returned to the Chief of Engineers, U. S. Army.

The Board of Engineers for Rivers and Harbors has carefully considered the report upon a preliminary examination of the Green River, Kentucky, from Lock No. 6 to Munfordville, and in connection therewith has reviewed the reports of previous examinations and surveys.

The existing project for the improvement of Green River provides for slack-water navigation from near the mouth of the river to Mammoth Cave, and upon its completion by the construction of Lock and Dam No. 6 will have created on the river and its tributaries a navigable waterway 257 miles in length. This examination is for the purpose of determining the advisability of extending this waterway to Munfordville, a distance of 27 miles.

In a report on a survey of this portion of the river in 1899 an estimate of $27,000 was submitted for its improvement by the removal of snags and overhanging trees, so as to enable steamboats to reach Munfordville during high stages of water. The district officer now reports that open-channel work through this portion of the river would do little good, as the volume of water is small and the slope is steep, and recommends continuing the slack-water improvement from Mammoth Cave to Munfordville, for which purpose three locks and dams will be required.

The extension of slack-water navigation on Green River from the Big Barren River to Mammoth Cave was for the purpose of opening up the extensive mineral deposits of this portion of the country. The district officer reports that there is no expectation of any great development in this line from a further improvement of the stream, but thinks that the timber interests are of sufficient importance and extent to warrant the improvement and that in addition there will be considerable river movement of farm products, general merchandise, and coal for local consumption. The division engineer does not concur in this opinion.

The board is of the opinion that the movement of timber can be provided for sufficiently by an open channel, and agrees with the division engineer that the amount and character of the commerce to be benefited will not justify at the present time a further extension of slack-water navigation on the Green River.

For the board:

D. W. LOCKWOOD,
Lieut. Col., Corps of Engineers,
Senior Member of the Board.

Following is an extract from the report of the district engineer:

Benefits to be derived from proposed improvement.—The most important interest which will be affected by the proposed improvement is the lumber interest. The large quantities of excellent timber lying along this stretch of the Green River is at present little used, and such logs as are cut are brought out only with great inconvenience and large cost. Some lumber is cut in the belts nearest the railroads, but the larger part is practically excluded from market. The cross-tie industry is developing for a few miles just above the cave, and this industry will be greatly benefited by the construction of locks and dams. The mineral resources of this district, while important, especially the limestones and clays, do not justify at present the improvement of the stream, as there is no expectation of any great development in this line even with an improved stream. But it is probable that should this section be given the benefit of cheap water transportation, there would be a small immediate development of the mineral resources with good prospects of future growth. The miscellaneous freight trade on an improved river, while insufficient in itself to justify the improvement, would be large and would be of the utmost importance locally.

The farmers and others on the river, judging by the already improved lower river, would use the river for shipping farm produce and for securing supplies from the towns. This trade is now by wagon over country road, and the saving in freight, therefore, would be very great. For Munfordville the improvement is of great importance, as the town is now dependent for transportation on a single line of railroad. It is probable that most of the coal used at Munfordville would, with an improved stream, be brought from the lower Green instead of by rail from the east at a saving of at least $1 per ton. While this item is small, it still would involve an annual saving of over $12,000. The improvement of the river would probably effect a reduction in

freight rates for other classes of freight brought into or sent out of Munfordville. All of this, however, is chiefly of local concern. Summarizing, it is thought that the timber interests are of sufficient importance and extent to warrant the improvement, and, in addition, there will be a considerable river movement of farm products, general merchandise, and coal for local consumption, as well as such traffic as the mineral resources may develop.

In view of the above and the statistics presented in the accompanying papers, I am of the opinion that the Green River from Mammoth Cave to Munfordville is worthy of improvement by construction of locks and dams. * * * No survey will be necessary, as there are sufficient data upon which to prepare the estimate. * * *

Sabine-Neches Canal, Texas. The following is from House Document No. 836, Sixty-first Congress, second session. The Chief of Engineers concurs:

THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., March 28, 1910.

Respectfully returned to the Chief of Engineers, U. S. Army.

The district officer presents herein a project for a ship channel to connect Port Arthur Canal at the mouth of Taylors Bayou with Orange and Beaumont on the Sabine and Neches rivers. He proposes a depth of 25 feet throughout with bottom widths of 100 feet in the canal section, 150 feet in open-river sections and in cut-offs, with considerable widening at the towns of Beaumont and Orange for turning basins. He also proposes to connect this waterway with Sabine Lake at or near Port Arthur to provide for light-draft traffic with Johnsons Bayou or points on Sabine Lake, this connection to be in lieu of the present channels at the mouths of the Neches and Sabine rivers which the district officer believes will fill up if the ship channel is constructed. He places the cost of this item at $50,000. The estimate for the entire 25-foot waterway is as follows:

Channel from Port Arthur Ship Canal to mouth of Neches River, including guard lock and opening into Sabine Lake	$935,000
Channel from Neches River to Orange, including turning basin	490,000
Channel from mouth of Neches River to Beaumont, including turning basin	420,000
Total	1,845,000

The estimate for maintenance is placed at $52,000 per year. It appears that the localities interested propose to contribute $598,000 toward the improvement, as explained within and in the report on preliminary examination. The district officer concludes with the opinion that it is not advisable for the General Government to undertake this work with or without local assistance. The division engineer appears to be in accord with the views of the district officer.

At the request of interested parties, a hearing was given at the offices of the board on March 15, 1910, which was attended by Hon. Martin Dies, M. C., and a delegation of citizens from Beaumont, and on March 21, 1910, Hon. Joseph W. Bailey, United States Senator, appeared before the board in reference to this improvement. It is claimed by those in interest that a channel of less width than that proposed by the district officer will meet present requirements of navigation, and if the width is reduced to 80 feet in canal and cut-off sections, with a corresponding reduction in area of turning basins, the connection with Lake Sabine omitted as not being an essential part of the project under consideration, and the cost per yard reduced 1 to 2 cents, which they claim is possible, then the waterway can be constructed for a sum not greatly in excess of double the amount they are prepared to contribute. It is their desire to pay half the cost provided their share can be made to fall within their means, which at present is limited to about $600,000.

In order that the subject might be considered from the various points of view presented, the board secured from the district officer an estimate for a waterway of the dimensions proposed by those in interest, from which it appears that the cost, using the same unit prices as originally considered by the district officer, which he believes are as low as can be secured, would be as follows:

Channel from Port Arthur Ship Canal to mouth of Neches River, including guard lock but not opening into Sabine Lake	$716,000
Channel from Neches River to Orange, including turning basin	351,000
Channel from mouth of Neches River to Beaumont, including turning basin	333,000
Total	1,400,000

If a uniform price of 9 cents per cubic yard be taken, which interested parties believe the work can be done for, the cost of the project would be $1,223,970, omitting the connection with Sabine Lake at or near Port Arthur.

While it may be possible with the exercise of due care to navigate slowly the channel proposed in the Neches River with vessels of moderate size, it is too crooked in many places for practicable navigation by vessels of 300 to 400 feet in length and 20 to 25 feet draft, and unless the dimensions and alignment of channel provide for this class of vessels the waterway would be of little more value than the present barge canal. It is believed that at least 3 cut-offs, in addition to those proposed by the district officer, having an aggregate length of about 9,000 feet and a yardage of about 1,000,000, will be required for a practicable ship channel. A radius of 2,000 to 2,500 feet is about the minimum curvature allowable for a channel 25 feet in depth, and there are five bends on the Neches reach with radii of from 1,200 to 1,600 feet.

While the claim that a channel with a bottom width of 80 feet will meet the present needs of commerce is no doubt true, as there is but little commerce over this waterway at present, it seems almost certain that if such a channel were constructed there would be an early demand for increased dimensions, whether the improvement were successful or not, for if a large commerce developed a more commodious channel would undoubtedly be required, and if it did not develop the reason assigned would probably be lack of adequate dimensions. The probability of large additional expenditures in the future must therefore be faced if the project is undertaken. Attention is also invited to the fact that all future expenditures for maintenance, as well as for increase of facilities, must be borne by the General Government, as no proposition has been made for local cooperation beyond sharing in the first cost of construction.

The board is of opinion that the dimensions proposed by the district officer are not greater than required for practicable navigation by such vessels as would be expected to use a ship channel 25 feet in depth. It is true that a large commerce has developed through the Port Arthur Canal, which is of less width than proposed for the project of extension. The necessity for greater width in the Port Arthur Canal has, however, been manifest for some time, and a favorable report looking toward a material increase in width has recently been submitted.

As stated in its indorsement on the report on preliminary examination, the General Government has expended in excess of $4,000,000 in establishing a seaport at Sabine, and has also taken over the Port Arthur Canal with the expectation of maintaining a suitable waterway to Port Arthur, where there are large terminal facilities capable of further extension. It has also provided an excellent barge channel for light-draft navigation to connect Port Arthur with the Neches and Sabine rivers. The consolidation and amplification of the Port Arthur and Sabine projects at a further cost of $2,000,000 has recently been recommended by this board, and in its opinion adequate provision has been made or recommended for the needs of the present and reasonably prospective commerce of this locality.

While the board recognizes that Beaumont and Orange would reap material advantages from the improvement now desired, it does not believe that the benefits to the general public would be sufficient to justify the Federal Government in extending the port facilities farther inland at this time. It seems clear to the board that any great development of seagoing commerce at Beaumont or Orange must be largely at a corresponding loss of development at Sabine or Port Arthur, where the efforts of the General Government are now concentrated and where at comparatively small expense additional terminal facilities can be provided.

In view of the foregoing the board expresses the opinion, concurring with the views of the district officer and the division engineer, that it is not advisable at this time for the United States to enter upon the construction of a channel 25 feet in depth from Port Arthur to Beaumont and Orange, either with or without local cooperation.

The district officer describes existing wharves and terminal facilities, and attention is respectfully invited to his remarks on this subject. In compliance with the provisions of section 13 of the act of March 3, 1909, the board reports that there are no questions of waterpower or other subjects so related to the project proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures made in the interests of navigation.

For the board:

WM. T. ROSSELL,
Colonel, Corps of Engineers,
Senior Member of the Board.

COMMERCIAL STATISTICS FROM JANUARY 1 TO DECEMBER 31, 1909.

Sabine-Neches Canal.

VESSELS ENTERING AND DEPARTING.

Class.	Number.	Trips.	Net registered tonnage.
Steamers	13	269	5,806
Sailing vessels	2	40	800
Barges	22	395	69,088
Total	37	704	75,749

SHIPMENTS AND RECEIPTS BY WATER.

Article.	Tons.	Value.
Shipments and receipts:		
Lumber and square timber	48,000	$432,000
Sand and shell	18,000	27,000
Fuel oil	35,400	177,000
Asphalt	2,100	31,500
Fresh water	6,000	9,000
Merchandise	450	33,750
Cattle and hogs	50	3,000
Coal and cord wood	500	2,000
Rice	135	5,400
Farm produce, etc	200	8,000
Machinery and iron	190	11,400
Grand total	111,025	740,050

Neches River, Texas.

VESSELS ENTERING AND DEPARTING.

Class.	Number.	Trips.	Net registered tonage.
Steamers	12	255	4,145
Sailing vessels			
Barges	14	356	36,584
Total	26	611	40,729

SHIPMENTS AND RECEIPTS BY WATER.

Articles.	Tons.	Value.
Shipments:		
Sand and shell	52,000	$78,000
Lumber and square timber	6,175	55,575
Fuel oil	37,034	185,170
Asphalt	400	6,000
Cord wood and coal	1,500	6,000
Spring water	400	1,400
Merchandise and feed	383	15,320
Produce	100	4,000
Total	97,992	351,465
Receipts:		
Saw logs	58,600	146,500
Machinery and iron	250	12,500
Rice	135	5,400
Miscellaneous	300	6,000
Total	59,285	170,400
Grand total	157,277	521,865

Sabine River, Texas.

VESSELS ENTERING AND DEPARTING.

Class.	Number.	Trips.	Net registered tonnage.
Steamers	7	193	4,074
Sailing vessels			
Barges	13	128	27,384
Total	20	321	31,458

SHIPMENTS AND RECEIPTS BY WATER.

Articles.	Tons.	Value.
Shipments:		
Lumber and square timber	45,857	$412,713
Sand and shell	30,000	57,000
Rice	1,468	58,120
Cattle	500	25,000
Cotton and cotton seed	15	2,250
Total	85,835	555,083
Receipts:		
Saw logs	258,000	645,000
Merchandise	300	18,000
Miscellaneous	100	5,000
Total	258,400	668,000
Grand total	344,225	1,223,083

Terminal facilities.—Orange, Tex., at the upper end of the proposed improvement on the Sabine River, is a city of some 8,000 people. It has 3 railroads, the Southern Pacific, the Frisco, and the Santa Fe, the latter, however, having only trackage rights over the Frisco tracks. The proposed basin at Orange has been so located that both the railroads at Orange will have water-front property on this basin, so that the transfer of freight between boats and railroads can be easily and cheaply made. It seems proper, however, to state that the railroad-front property at Orange is very limited, and not susceptible of any great expansion except at considerable cost. Orange has 4 large sawmills, 1 large rice mill, and 1 large paper mill. All of these, with the exception of the paper mill, have water frontage on the proposed terminal basin and are in a most favorable location to utilize the proposed waterway.

Along the Sabine River below Orange the country is low, making it more than likely that only at Orange will there ever be any terminal facilities projected.

Beaumont, Tex., at the head of the proposed improvement on the Neches River, is a city of some 30,000 people. It has 4 railroad systems—the Southern Pacific, Santa Fe, Frisco, and Kansas City Southern. The proposed basin at Beaumont has been so located that the most advantageous terminal property at present in the city will front upon this basin. Practically all the water frontage at Beaumont is controlled by the Beaumont Wharf and Terminal Company, a railroad company organized under the laws of Texas and subject to the jurisdiction of the state railroad commission. It is a belt railroad, connecting all the railroads at Beaumont, giving all of them access to its splendid water frontage on the proposed basin. Already a $40,000 wharf has been built here by the city, with ample trackage facilities for the handling of all kinds of freight. The wharf and wharf charges are under the jurisdiction of the city, and if any charges are made they will be the same to all users. But to reach this wharf it is necessary to use the Beaumont Wharf and Terminal Company's railroad, thus permitting this company to levy its tribute on all shipments through Beaumont.

Along the Neches River below Beaumont the bluffs reach out to or near the river at several places, so that terminal facilities along the Neches River are not restricted to Beaumont, but at little cost are available at several different points on the river below Beaumont.

The people of Beaumont and Orange realize that this improvement would mean a great deal to both cities. The faith they have in the advantages it will cause their two cities is shown by the fact that during the past year they have voted for a bond issue of $598,000, which was referred to in the preliminary report.

Amendments to the number of 207 were referred to and considered by the committee calling for appropriations amounting to $12,815,259 and authorizations to $5,150,617, a total of $17,965,876.

Increases and decreases as reported to Senate.

	Increase in appropriation.	Increase in contract authorization.
Maine:		
East Boothbay Harbor	$2,500	.....
Rockport Harbor	32,000	.....
Saco River	10,000	.....
St. Croix River	76,000	.....
Massachusetts:		
Fall River Harbor	143,000	.....
Provincetown Harbor	5,000	.....
Rhode Island:		
Newport Harbor	50,000	$183,000
Point Judith Harbor of Refuge	165,000	.....
Providence River and Harbor	.....	194,000
Connecticut:		
Bridgeport Harbor	45,000	.....
New York:		
Dunkirk Harbor	99,275	.....
Plattsburg Harbor	26,500	.....
Hudson River	1,000,000	.....
Shooters Island Channel, N. Y. and N. J	100,000	180,115
New Jersey:		
Keyport Harbor Group	10,000	.....
Delaware River, Philadelphia, Pa., to Trenton, N. J	95,000	260,000
Delaware River, Pa., N. J., and Del	250,000	.....
Delaware:		
Leipsic River	18,500	.....
Maryland:		
Nanticoke River	2,850	.....
Rockhall Harbor Group	20,000	.....
District of Columbia:		
Anacostia River	109,000	.....
Virginia:		
Potomac River at Alexandria	40,000	.....
James River	150,000	.....
Norfolk Harbor and approaches	300,000	.....
North Carolina:		
Cape Fear River above Wilmington	90,000	515,000
Cape Fear River below Wilmington	200,000	.....
Beaufort Channel	27,676	.....
Smiths Creek	16,250	.....
Bogue Sound	19,000	.....
Swift Creek	1,600	.....
South Carolina:		
Waccamaw River	86,000	.....
Georgia:		
Coosa River, Mayos bar	45,000	.....
Altamaha, Oconee, and Ocmulgee rivers	15,000	.....
Florida:		
St. Johns River, Jacksonville to the ocean	115,000	.....
St. Johns River	32,400	.....
St. Andrews Bay	32,605	128,560
Carrabelle Harbor	10,000	.....
Santa Rosa Sound	24,000	.....
Alabama:		
Coosa River Lock No. 4 and site for Dam No. 5	25,000	.....
Mississippi:		
Gulfport Harbor	32,500	.....
Tombigbee River	5,000	.....
Louisiana:		
Atchafalaya River	540,000	.....
Kentucky:		
Green River, Dam No. 7	250,000	.....
Texas:		
Galveston Harbor	100,000	.....
Galveston Harbor to Texas City	50,000	.....
Sabine-Neches Canal	200,000	.....
Arkansas:		
Arkansas River, new dredge	375,000	.....
Ouachita River	10,000	.....
West Virginia:		
Tug Fork of Big Sandy River, W. Va. and Ky	50,000	.....
Guyandot River	5,000	.....
Little Kanawha River	4,500	.....

Increases and decreases as reported to Senate—Continued.

	Increase in appropriation.	Increase in contract authorization.
Ohio:		
Fairport Harbor		$150,000
Lorain Harbor	$10,611	
Ohio River	150,000	1,000,000
Michigan:		
Arcadia Harbor	20,000	
Saginaw River and Bay	25,000	636,000
Manistee Harbor	22,000	
Rogers City Harbor	6,000	
Wisconsin:		
De Pere Harbor	11,500	
Port Washington	7,500	
Minnesota:		
Mississippi River, Headwaters Canal	61,200	
Mississippi River, Brainerd to Grand Rapids	22,555	
Warroad Harbor	7,700	
Missouri River:		
Missouri River, near St. Joseph, Mo	75,000	
Missouri River, Kansas City to Fort Benton	125,000	
California:		
Sacramento and Feather rivers	15,000	
Los Angeles Harbor	200,000	
Redwood Creek	12,000	
Oregon:		
Clatskanie River	4,700	
Coquille River	28,160	
Siuslaw River	50,000	881,000
Willamette Falls Canal, purchase of, Oregon	800,000	
Washington:		
Columbia River, mouth of Willamette to Vancouver, Wash	2,500	
Cowlitz and Lewis rivers	19,100	
Willapaw River and Harbor	20,000	
Grays Harbor, jetties	75,000	
Grays Harbor	17,500	
Columbia River, Bridgeport to Kettle Falls	50,000	
Snake River, Oreg., Wash., and Idaho	17,500	
Alaska:		
St. Michael Canal	43,000	
J. H. Bankhead, expenses as commissioner	1,875	
Total increases	6,450,567	3,627,675
Deductions:		
Fairport Harbor, Ohio $50,000		
Navigation Congress 20,000		
Total decreases	70,000	
Net increase	6,380,567	3,627,675
Net increase in appropriations and contract authorizations	10,008,242	

Memoranda relating to appropriations included in river and harbor bill.

[Reported to the United States Senate by the Committee on Commerce, April 11, 1910.]

APPROPRIATIONS BY STATES.

State.	Rivers.	Harbors.	Waterways.	Miscellaneous.	Total.
Maine	$105,000.00	$194,500.00			$299,500.00
New Hampshire		40,000.00			40,000.00
Vermont		57,000.00			57,000.00
Massachusetts	92,000.00	653,000.00			745,000.00
Rhode Island	15,000.00	959,500.00			974,500.00
Connecticut	76,500.00	343,000.00			419,500.00
New York	1,419,000.00	2,934,420.00			4,353,420.00
New Jersey	[a] 604,050.00	310,115.00			[a] 914,165.00
Pennsylvania	[a] 1,013,445.50	70,000.00			[a] 1,083,445.50
Delaware	138,360.00	109,500.00	$1,500.00		249,360.00
Maryland	114,900.00	106,855.00			221,755.00
District of Columbia	430,000.00				430,000.00
Virginia	474,600.00	668,000.00	12,100.00		1,154,700.00
West Virginia	89,000.00				89,000.00
North Carolina	1,135,550.00	72,926.00	51,575.00		1,260,051.00
South Carolina	196,000.00	300,000.00	25,000.00		521,000.00
Georgia	560,500.00	470,000.00	33,200.00		1,063,700.00
Florida	666,010.00	715,060.00	153,500.00		1,534,570.00
Alabama	[b] 1,599,000.00	464,000.00			[b] 2,063,000.00
Mississippi	211,000.00	109,500.00			320,500.00
Louisiana	[c] 1,828,000.00		112,500.00		[c] 1,940,500.00
Arkansas	[c] 751,400.00				[c] 751,400.00
Texas	1,661,500.00	1,168,580.00	712,900.00		[d] 3,542,980.00
Tennessee	[e] 1,129,312.00				[e] 1,129,312.00
Kentucky	499,000.00				499,000.00
Ohio		1,516,330.00			1,516,330.00
Ohio River	5,325,000.00				5,325,000.00
Michigan	1,907,000.00	776,400.00			2,683,400.00
Wisconsin	27,000.00	777,000.00			[f] 804,000.00
Minnesota	11,700.00	261,700.00			[f] 273,400.00
Indiana		127,500.00			127,500.00
Illinois	303,000.00	280,000.00	75,000.00		658,000.00
Mississippi River	3,583,755.00				3,583,755.00
Waterway, Lakes to the Gulf			1,050,000.00		1,050,000.00
Missouri, including lower river	1,205,000.00				1,205,000.00
Missouri River, upper	300,000.00				300,000.00
California	541,500.00	1,103,000.00			1,644,500.00
Oregon	1,996,200.00	405,000.00			[g] 2,401,200.00
Washington	1,432,100.00	105,000.00	2,299,000.00		[g] 3,836,100.00
Montana		6,000.00			6,000.00
Alaska			143,000.00		143,000.00
Hawaii		500,000.00			500,000.00
Porto Rico		20,000.00			20,000.00
Examinations, surveys, etc				$500,000.00	500,000.00
Emergencies				300,000.00	300,000.00
Navigation Congress				30,000.00	30,000.00
Inland Waterways Commission				1,875.00	1,875.00
	31,441,382.50	15,623,886.00	4,669,275.00	831,875.00	52,566,418.50

SUMMARY.

Atlantic coast	$6,409,682.50	$5,677,256.00	$123,375.00		$12,210,313.50
Gulf coast	4,857,500.00	2,407,140.00	873,900.00		8,138,540.00
Pacific coast	3,969,800.00	1,619,000.00	2,299,000.00		7,887,800.00
Great Lakes	2,215,000.00	5,400,490.00			7,615,490.00
Mississippi Valley:					
Mississippi River	3,583,755.00				
Tributaries on east side	7,730,545.00		1,125,000.00		15,211,900.00
Tributaries on west side	2,667,600.00		105,000.00		
Hudson Bay Basin	7,500.00				7,500.00
Alaska, Hawaii, and Porto Rico		520,000.00	143,000.00		663,000.00
Miscellaneous				$831,875.00	831,875.00
Total	31,441,382.50	15,623,886.00	4,669,275.00	831,875.00	52,566,418.50

[a] Delaware River below Philadelphia is charged to Pennsylvania and the section between Philadelphia and Trenton to New Jersey.

[b] Includes $410,000 for Tennessee River between Chattanooga and Riverton and at Colbert and Bee Tree shoals.

[c] Includes half of $521,000 for Ouachita River.

[d] Includes $50,000 for Red River above Fulton, Ark.; $100,000 for Caddo Lake, etc.; and $5,000 for Cypress Bayou.

[e] Does not include $410,000 for Tennessee River between Chattanooga and Riverton and at Colbert and Bee Tree shoals, credited to Alabama.

[f] Includes one-half of $500,000 for Duluth-Superior Harbor and of $4,000 for St. Croix River.

[g] Includes one-half of sum of items for Snake and Columbia rivers, except $175,000 below Portland, which goes to Oregon alone, and $75,000 above Snake River to Washington alone.

INDEX TO RIVER AND HARBOR REPORT.

A.

	Page.
Agate Bay, Minn	572
Alabama River, Ala	326
Alabama and Coosa rivers, Ala	327
Allegheny River, Pa	137, 138
Alloway Creek, N. J	112
Alpena Harbor, Mich	505
Altamaha, Oconee, and Ocmulgee rivers, Ga	259
Anacostia River, D. C	171, 689
Anclote River, Fla	295
Apalachicola Bay Harbor, Fla	278
Apalachicola River, to St. Andrews Bay, Fla	292
Apalachicola, Chipola, and Upper Chipola rivers, Fla	295
Appomattox River, Va	185
Appoquinimink, Murderkill, and Mispillion rivers, Del	148
Appropriations for each State	773
Aransas Pass, Tex	394
Aransas Pass–Corpus Christi channel, Tex	424
Arcadia Harbor, Mich	695
Arkansas River, Ark	439
Arkansas River up to Muscogee, Ind. T	693
Arthur Kill, N. Y. and N. J	102
Ashland Harbor, Wis	542
Ashtabula Harbor, Ohio	695
Atchafalaya River, La	696

B.

Baltimore Harbor, Md	156, 157
Bayou Bartholomew, Bœuf River, Tensas River and Bayou Maçon, and bayous d'Arbonne and Corney, La. and Ark	356
Bayou Lafourche, La	365
Bayou Plaquemine, Grand River and Pigeon bayous, La	367
Bayou Plaquemine Brule, La	383
Bayou Quene de Tortue, La	384
Bayou Teche, La	377
Bayou Vermilion, La	383
Bayou Vermilion and Mermentau River, La	379
Bayou Terrebonne, La	378
Bay River, N. C	208
Bear Creek, Miss	356
Beaufort Harbor, N. C	205
Beaufort Inlet, N. C	206
Beaufort, N. C., channel to	735
Bellingham Harbor, Wash	657
Big Sandy River, W. Va. and Ky	469
Biloxi Harbor, Miss	337
Biscayne Bay, Fla	280
Black and Current rivers, Ark. and Mo	439
Black and Rouge rivers and Monroe Harbor, Mich	531
Black Rock Harbor, N. Y	62
Black Warrior and Tombigbee rivers, Ala	328
Blackfish Bayou, Ark	444
Blackwater River, Fla	298
Block Island Harbor of Refuge, R. I	29

	Page.
Boca Grande and Charlotte Harbor, Fla	697
Bogue Falia, Chefuncte, Tickfaw, and Amite rivers, and Bayou Manchac, La	362
Bogue Sound, N. C	699
Boston Harbor, Mass	11
Branford Harbor, Conn	41
Brazos River, Tex., Old Washington to Waco	418
Brazos River, Tex., Velasco to Old Washington	416
Bridgeport Harbor, Conn	42, 700
Broad Creek River, Del	152
Broadkill River, Del	153
Bronx River and East Chester Creek, N. Y	88
Browns Creek, N. Y	90
Brunswick Harbor, Ga	250
Buffalo Harbor, N. Y	64
Burlington, Vt	9

C.

Cache River, Ark	441
Calcasieu River, mouth and passes, La	360
Caloosahatchee River, Fla	300
Calumet Harbor, Ill	587
Calumet River, Ill. and Ind	583
Camden, Me	4
Cape Charles City Harbor, Va	180
Cape Fear River, at and below Wilmington, N. C	209
Cape Fear River above Wilmington, N. C	208
Cape Vincent Harbor, N. Y	66
Carrabelle Bar and Harbor, Fla	281
Charleston Harbor, S. C	233
Charlotte Harbor, Fla	697
Charlotte Harbor, N. Y	67
Chattahoochee River, Ga. and Ala	269
Chesapeake and Delaware Bays, waterway	701
Chicago Harbor, Ill	589
Chicago River, Ill	592
Choctawhatchie River, Fla. and Ala	317
Clatskanie River, Oreg	635, 702
Clearwater Harbor, Fla	283
Cleveland Harbor, Ohio	473
Clinch and Hiawassee rivers, Tenn	457
Clinton River, Mich	535
Club and Plantation creeks canal, Ga	264
Columbia River at Dalles Rapids to Celilo Falls	650
Bridgeport and Kettle Falls, Wash	663
Cascades	648
Gauging water	647
mouth of	644
and Lower Willamette, Oreg	641
Upper, to Snake River	652
Wash., Vancouver to mouth of Willamette	647
Wenatchee and Bridgeport, Wash	662
Conneaut Harbor, Ohio	481
Connecticut River, below Hartford, Conn	57
Contentnia Creek, N. C	212
Cooper Creek, N. J	114
Coos Bay, Oreg	632
Coos River, Oreg	637
Coosa River, Ga. and Ala	271, 274, 275
Coquille River, Oreg	638, 703
Cowlitz and Lewis rivers, Wash	665
Crisfield Harbor, Md	158
Crystal, Anclote, and Suwanee rivers, Fla	301
Cumberland River, Tenn. and Ky.:	
Above Nashville, Tenn	448
Below Nashville, Tenn	451
Cypress Bayou, Tex. and La	426

D.

	Page.
Darien Harbor, Ga	253
Delaware Bay, Del	144, 145
Delaware River, Pa. and N. J	127, 133
Delaware River, Philadelphia to Trenton	705
Delaware River, 35-foot depth, Philadelphia to the sea	704
De Pere Harbor, Wis	706
Detroit River, Livingstone Channel	722
Detroit River, Mich	536
Double Creek, N. J	706
Duck Island Harbor, Conn	45
Duluth Harbor, Minn., and Superior, Wis	563
Dunkirk Harbor, N. Y	707
Dymers Creek, Va	188

E.

East Boothbay Harbor, Me	5, 709
East Pearl River, Miss	341
East River and Hell Gate, N. Y	92
Echo Bay, N. Y	68
Eightmile River, Conn	59
Elk River, Md	168
Erie Harbor, Pa	133
Escambia and Conecuh rivers, Fla. and Ala	319

F.

Fairport Harbor, Ohio	482
Fall River Harbor, Mass	709
Fernandina Harbor, Fla	284
Fishing Creek, N. C	213
Fivemile River Harbor and others, Conn	46
Flint River, Ga	265
Fox River, Wis	562
Frankfort Harbor, Mich	710
French Broad and Little Pigeon rivers, Tenn	460

G.

Galveston channel, Tex	395
Galveston Harbor to Texas City, Tex	400, 406
Galveston Harbor, Tex	398
Gary Harbor, Ind	711
Gasconade River, Mo	607
Gloucester Harbor, Mass	13
Grand Haven Harbor, Mich	506
Grand Marais Harbor, harbor of refuge, Mich	508
Grand Marais Harbor, Minn	573
Grays Harbor and Bar entrance, Wash	713
Grays Harbor and Chehalis River, Wash	658
Grays River, Wash	669
Great Pedee River, S. C	240
Great Salt Pond Harbor, Block Island, R. I	31
Great Sodus Bay, N. Y	69
Great South Bay Harbor, N. Y	70
Green Bay Harbor, Wis	546
Green River, Ky	766
Greenwich Harbor, Conn	714
Gulfport Harbor, Miss	338
Guyandot River, W. Va	474

H.

Hackensack River, N. J	715
Hammersley Inlet, Puget Sound, Wash	660
Harbor Beach, harbor of refuge, Mich	510
Harlem River, N. Y	94
Hempstead Harbor, N. Y	71

	Page.
Hillsboro Bay, Fla	287, 716
Hillsboro River, Fla	304
Hilo Harbor, Hawaii	683
Hingham Harbor, Mass	14
Holland Harbor (Black Lake), Mich	511
Holmes River, Fla	305
Honolulu Harbor, Hawaii	684
Horn Island Pass, Miss	340
Housatonic River, Conn	60
Houston ship channel, Tex	402
Hudson River, N. Y	96, 720
Humboldt Bay, Eureka to Arcata, Cal	718
Humboldt Harbor, Cal	611
Huron Harbor, Ohio	484

I.

Illinois River, Ill	595
Illinois and Mississippi Canal	594
Indian River, Fla	306
Indiana Harbor, Ind	579
Inland waterway channel, Franklin-Mermentau, La	385
Inland waterway, Mermenteau River to Sabine River, La	386
Inland waterway, Norfolk to Albemarle Sound	203
Inland waterway to Sounds of North Carolina	204
Inland waterway, Pamlico Sound to Beaufort Inlet, N. C	229
Inland waterway on coast of Texas	420
Inside water route between Savannah, Ga., and Fernandina, Fla	276
Isle of Shoals, Me. and N. H	8

J.

Jamaica Bay, N. Y	72
James River, Va	188

K.

Kahului Harbor, Hawaii	685
Kanawha River, W. Va	475
Kenosha Harbor, Wis	547
Kentucky River, Ky	472
Kewaunee Harbor, Wis	543
Keweenaw Point, Mich., waterway across	540
Keyport Harbor, Matawan Creek, Raritan, and South rivers, Shoal Harbor, Compton, and Cheesequake creeks, N. J	105
Kiamichi River, Okla	394
Kissimmee River, Fla	307

L.

Lake Pontchartrain and Pass Manchoe, La	370
Lake Winnibigoshish and Leech Lake Canal, Minn	
Leipsic River, Del	720
Little Contentnio River, N. C	722
Little Kanawha River, W. Va	476
Little Pedee River, S. C	243
Livisa Fork, Big Sandy, Ky	469
Little Sodus Bay Harbor, N. Y	73
Lockport to mouth of Illinois River, waterway	600
Lorain Harbor, Ohio	485
Los Angeles Harbor, Cal. (San Pedro)	619, 723
Lower Thoroughfare, Deal Island, Md	167
Ludington Harbor, Mich	513
Lynn Harbor, Mass	15

M.

Mackinac Harbor, Mich	516
Manistee Harbor, Mich	516, 724
Manistique Harbor, Mich	518
Manitowoc Harbor, Wis	551

	Page.
Mantua Creek, N. J.	115
Marcushook, Pa.	134
Marquette Harbor, Mich.	520
Matinicus Harbor, Me.	5
Marquette Bay, Mich., harbor of refuge	519
Maurice River, N. J.	117
Menominee Harbor and River, Mich., and Wis.	541
Merrimac River, Mass.	25
Michigan City Harbor, Ind.	581
Milford Harbor, Conn.	50
Milford Haven Harbor, Va.	181
Milwaukee Harbor, Wis	549
Mingo Creek, S. C.	244
Miniscoongo River, N. Y.	725
Minnesota River, Minn.	576
Mississippi River between the Missouri River and Minneapolis	598
Brainerd to Grand Rapids, Minn.	726
Commission	596
from Head of the Passes to Ohio River	596
from mouth of Ohio River to mouth of Missouri	597
Headwaters, Canal, Minn.	729
St. Paul to Minneapolis, Minn.	727
Missouri River at Atchison, Kans.	730
general improvement	601
St. Joseph, Mo	606
Mobile Bar, Ala.	320
Mobile Bay and Mississippi Sound Channels, Ala.	731
Mobile Harbor, Ala.	321
Mokelumne River, Cal.	621
Monongahela River	139
Monroe Harbor, Mich.	523, 531
Mount Desert Breakwater, Me.	3
Muskegon Harbor, Mich.	523
Mystic River, Mass.	27

N.

Nansemond River, Va.	191
Nanticoke River, Md., Northwest Fork	169
Nanticoke River, Del. and Md	732
Nantucket Harbor, Mass.	16
Napa River and Petaluma Creek, Cal.	622
Neuse and Trent rivers, N. C.	213
New Bedford and Fairhaven harbors, Mass.	18
New Haven Harbor, Conn.	51
Newburyport Harbor, Mass.	19
Newport Harbor, R. I.	733
New River, N. C., and inland waterways	217
New London, Conn.	55
Newtown Creek, N. Y.	98
New York Harbor, N. Y.	74
Niagara River, N. Y.	99
Norfolk-Beaufort Inlet Waterway, Va. and N. C	736
Norfolk Harbor, Va.	182
Norfolk Harbor and Newport News, Va	184, 734
Norfolk, Va., to Albemarle Sound, N. C.	203
Norfolk, Va., to Sounds of N. C.	204
Nomini Creek, Va.	191
Northeast and Black rivers, and Cape Fear River above Wilmington, N. C.	221
Norwalk Harbor, Conn	56

O.

Oakland Harbor, Cal.	613
Obion and Forked Deer rivers, Tenn.	455
Ocklawaha River, Fla.	308
Oconto Harbor, Wis.	553
Ogdensburg Harbor, N. Y.	76

	Page.
Ohio River, 9-foot project	491
Ohio River, Dams 2, 3, 4, 5, 8, 11	508
Ohio River, general improvement	497
Oldmans Creek, N. J	118
Olympia Harbor, Wash	661
Onancock River, Va	193
Ontonagon Harbor, Mich	625
Orange River, Fla	309
Osage River, Mo	609
Oswego Harbor, N. Y	77
Ouachita River, Ark. and La	429
Ouachita River, Camden to Arkadelphia, Ark	736

P.

Pagan River, Va	193
Pamlico and Tar rivers, N. C	225
Pascagoula River, Miss	342
Pascagoula, Chickasahay and Leaf rivers, Miss	344
Pass Cavallo to Port Lavaca, Tex	405
Pawcatuck River, R. I. and Conn	40
Pearl River, Miss., below Rockport	346
Pearl River, Miss., between Edinburg and Jackson	347
Pensacola Harbor, Fla	289
Pepperells Cove, Me	6
Permanent International Association of Navigation Congresses	688
Petaluma Creek and Napa River, Cal	622
Petoskey Harbor, Mich	526
Pittsburg Harbor, Pa	135
Plattsburg Harbor, N. Y	737
Plymouth Harbor, Mass	21
Point Judith, R. I., harbor of refuge at	32
Polson Bay, Mont	681
Port Bolivar Channel, Tex	406
Port Chester Harbor, N. Y	79
Port Clinton Harbor, Ohio	486
Port Jefferson, Mattituck, Huntington, and Flushing Bay harbors, N. Y	80
Port Washington, Wis	554
Port Wing, Wis	556
Portage Lake, harbor of refuge, Mich	527
Potomac River at Washington, D. C	173
at Lower Cedar Point	178
below Washington	176
at Alexandria	177
at Mount Vernon	179
Providence River and Harbor, R. I	37, 40
Provincetown Harbor, Mass	22, 738
Puget Sound, Wash., and tributaries	670
Puget Sound-Lake Washington waterway, lock construction	672
Puget Sound and Lakes Union and Washington waterway, maintenance	675

R.

Racine Harbor, Wis	558
Raccoon Creek, N. J	118
Rappahannock River, Va	194
Raritan Bay Harbor, N. J	111
Red River, La., Ark., Tex., and Okla	389
Red River of the North, Minn. and N. Dak	577
Redwood Creek, Cal	739
Rehoboth and Delaware Bays Canal, Del	740
Roanoke River, N. C	226
Rockhall, Queenstown, Claiborne, and Cambridge harbors; Choptank, Warwick, and Manokin rivers, and Tyaskin Creek, Md	159
Rockport Harbor, Me	741
Rogers City Harbor, Mich	742
Rondout and Peekskill harbors, N. Y	84
Rouge River, Mich	531

S.

	Page.
Sabine-Neches Canal, Tex	769
Sabine Pass and Port Arthur Ship Canal, Tex	743
Sabine Pass, harbor, Tex	409
Saco River, Me	7, 748
Sacramento and Feather rivers, Cal	624, 628
Saginaw River, Mich	538, 749
St. Albans, Vt	10
St. Andrews Bay, Fla	291
St. Clair River, Mich	750
St. Croix River, Me	751
St. Croix River, Wis. and Minn	571
St. Francis and L'Anguille rivers, Ark	442
St. Johns River, Fla., Jacksonville to the ocean	310, 764
St. Johns River, Fla., opposite Jacksonville	313
St. Johns River, Jacksonville to Lake Harney	314
St. Jones River, Del	154
St. Lucia Inlet, Fla	752
St. Michael Canal, Alaska	681, 763
Saline River, Ark	445
Salem River, N. J	120
Sandy Bay Harbor, Mass	24
Sandusky Harbor, Ohio	487
San Diego Harbor, Cal	616
San Francisco, Cal	617
San Joaquin River, Cal	628
San Juan Harbor, Porto Rico	686
Santa Rosa Sound Narrows, Fla	754
Santee, Wateree, and Congaree rivers, and Estherville-Minim Creek Canal	245
Sapelo Harbor, Ga	254
Sarasota Bay, Fla	293
Saugatuck Harbor and Kalamazoo River, Mich	529
Saugerties Harbor, N. Y	86
Savannah Harbor, Ga	255
Savannah River, above Augusta, Ga	266
Savannah River, below Augusta, Ga	269
Savannah River at Augusta, Ga	268
Scuppernong River, N. C	227
Shallowbag Bay, N. C	207
Sheboygan Harbor, Wis	559
Shooters Island Channel, N. Y. and N. J	750
Shrewsbury River, N. J	122
Siuslaw River, Oreg	755
Skagit River, Wash	677
Smiths Creek, N. C	756
Smyrna River, Del	155
Snake River, Oreg., Wash., and Idaho	654
Snohomish River, Wash	678
South Haven Harbor, Mich	530
South Pass Channel, Mississippi River, maintenance and improvement of	372
South River, N. C	228
Southwest Pass, Mississippi River	374
Steele and Washington bayous, Miss	355
Stockton Harbor, Me	6
Stockton and Morman channels, Cal. (*See* San Joaquin River.)	
Sulphur River, Tex	428
Suisun Channel, Cal	631
Susquehanna River, Havre de Grace, Md	170
Swift Creek, N. C	757
Swinomish Slough, Wash	679

T.

Tacoma Harbor, Puyallup Waterway, Wash	758
Tampa Bay, Fla	294
Tarrytown Harbor, N. Y	87
Taunton River, Mass	28
Tennessee River	462

Page.

Thames River, Conn 61
Tillamook Bay and Bar, Oreg 633
Toledo Harbor, Ohio 499
Tombigbee River, Columbus to Walker's Bridge, Miss 335
Tombigbee River, Ala. and Miss., Demopolis to Columbus 334
Tombigbee River, from mouth to Demopolis 333
Toms River, N. J 124
Trinity River, Tex 419
Tuckerton Creek, N. J 124
Two Rivers Harbor, Wis 561

U.

Upper Machodoc Creek, Va 196
Urbana Creek, Va 197

V.

Vermilion Harbor, Ohio 490

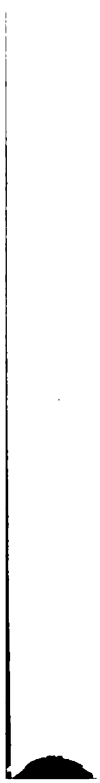
W.

Waccamaw River, N. C. and S. C 231
Wappinger Creek, N. Y 99
Warroad Harbor, Minn 759
Water hyacinths, removal of, Fla. waters 316
Water hyacinth, removal, La. and Tex 387
Water route, Savannah, Ga., to Fernandina, Fla 276
Waterway, between Jefferson, Tex., and Shreveport, La 427
Charleston and Alligator Creek, S. C 249
Chesapeake and Delaware bays 701
coast of Va 202
Franklin to Mermentau, La 385
from Lockport, Ill., to mouth of Illinois River 600
Mermentau River to Sabine River, La. and Tex 386
Pamlico Sound to Beaufort Inlet, N. C 229
Puget Sound to Lakes Union and Washington 672, 675
Swan Quarter Bay, N. C 230
Waukegan Harbor, Ill 591
Westchester Creek, N. Y 101
West Galveston Bay and channel, Tex 411
Weymouth Back River, Mass 29
White Lake and Pentwater Harbors, Mich 760
White River, Ark 446
Wickford Harbor, R. I 763
Wicomico River, Md 171
Willamette River above Portland, and Yamhill River 639
Willamette River, Lower, Oreg., below Portland, and Columbia River 641
Willamette River, purchase of canal and locks 762
Willapa River and Harbor, Wash 680
Wilmington Harbor, Cal 619
Wilmington Harbor, Del 146
Winyah Bay, S. C 238
Withlacoochee River, Fla 315
Wolf and Jordan rivers, Miss 348
Woodbridge Creek, N. J 126

Y.

Yazoo River, mouth, and Vicksburg Harbor, Miss 349
Yazoo, Tallahatchie, Coldwater, and Tchula Lake, Miss 351
York River, Mattaponi and Pamunkey rivers, Va 198
Youghiogheny River, Pa 142

O



DUE MAR 17 42

Eng 1019.10
(Report on the river and harbor bil
Cabot Science 0041409
3 2044 091 965 087